Radiological Health Data

VOLUME III, NUMBER 7

JULY 1962

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service

In August 1959, the President directed the Secretary of Health, Education, and Welfare to intensify Departmental activities in the field of radiological health. The Department was assigned responsibility within the Executive Branch for the collation, analysis and interpretation of data on environmental radiation levels. The Department delegated this responsibility to the Division of Radiological Health, Public Health Service.

Radiological Health Data is published by the Public Health Service on a monthly basis. Data are provided to the Division of Radiological Health by other Federal agencies, State health departments, and foreign governments. Except where material is directly quoted or otherwise credited, summaries and abstracts are prepared by the Radiological Health Data and Reports Staff, Division of Radiological Health. The reports are reviewed by a Board of Editorial Advisors with representatives from the following Federal agencies:

Department of Health, Education, and Welfare
Atomic Energy Commission
Department of Defense
Department of Agriculture
Department of Commerce

For further information on any subject reported in this issue, readers are referred to the contributors indicated in the headings of the articles.

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RADIOLOGICAL HEALTH DATA

VOLUME III, NUMBER 7
JULY 1962

TABLE OF CONTENTS

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service • Division of Radiological Health

ADVANCE REPORT

Public Health Service

The Public Health Service Pasteurized Milk Network June monthly tabulations for 61 stations show an average iodine–131 concentration of 30 μμc/liter. During March and April the average monthly figures for milk were less than 10 μμc/liter. In May they increased to 20 μμc/liter. Relatively high values were detected in June in several states located generally in the Midwest and Northwest. Monthly average concentrations of more than 20 μμc/liter were noted at 16 stations. Monthly averages greater than 100 μμc/liter occurred at four stations. The monthly average for the station with the highest reported concentrations was 350 μμc/liter.

U.S. Naval Research Laboratory

Results from the May 1962 samples, U.S. Naval Research Laboratory 80th Meridian (West) Sampling Program, indicate the arrival of fresh debris from the Christmas Island tests at Lima, Chacaltaya, Antofagasta, and Santiago. The influx of fresh debris from the Christmas Island area is not apparent in the Northern Hemisphere because of the levels of gross beta activity from the Fall 1961 U.S.S.R. nuclear testing series.

Atomic Energy Commission

The June 13 Nevada Test Site detonation was not fully contained underground. Part of the radioactivity escaped to the atmosphere and was carried north by prevailing winds. Data now available indicate that the highest off-site exposure level was about one-quarter roentgen.

The radioactivity from the detonation drifted north from the Test Site, crossed Nevada Highway 25 in the Queen Summit area, and then crossed State Highway 6 between Lockes and Currant. It moved on north and crossed U.S. Highway 50 west to Ely, widening and losing intensity as it moved.

At the distance of Highway 25 in the Queen Summit area (unpopulated), transient levels of radioactivity rose to a maximum of 160 milliroentgens per hour, and at Nyala (inhabited by about 6 persons) were 100 milliroentgens per hour or below. At both locations, the levels dropped within two to three hours to a few milliroentgens per hour.

The release of June 13 contributed in part to the levels of radioiodine found in the Pacific Northwest during the latter part of June.

Considerably smaller but measurable releases of radioactivity offsite have occurred after four previous underground detonations since underground testing was resumed in September 1961. The detonations involved were those of September 15, 1961; March 5, 1962; April 14, 1962; and May 19, 1962. Barely detectable releases of radioactivity off-site occurred after a few other detonations.

All of the off-site radiation levels have been within limits in use at the Nevada Test Site for the past several years.

In accordance with established procedures for reporting data on environmental radioactivity, data on the first two releases have been published in *Radiological Health Data* (issues of November 1961 and May 1962). Collection and collation of data on the other releases of radioactivity are continuing, and the results will be published in later issues of *Radiological Health Data.*

Food and Drug Administration

The resumption of nuclear weapons testing in the atmosphere on September 1, 1961, is now reflected in recently received Food and Drug Administration reports of increased strontium–90 concentrations in selected raw foods when measured against pre-test surveillance data gathered in 1960 and 1961. Six Southeastern samples of lettuce assayed 54 μμc/kg (range 19–178), and 5 Pacific samples assayed 56 μμc/kg (range 64–126) after September 15, 1961, while 19 country-wide samples assayed 1.8 μμc/kg (range 0.3–4.3) prior to the above date. Eight Middle Atlantic samples of spinach assayed 24 μμc/kg (range 7–34), and 5 Pacific and Southwest samples assayed 86 μμc/kg (range 33–167) after September 15, 1961, while 22 country-wide samples assayed 5.3 μμc/kg (range 2.7–9.2) prior to the above date.

Editor's note: The above information is preliminary and subject to further confirmation. It summarizes recent data submitted to the Radiation Surveillance Center, Division of Radiological Health, Public Health Service.

SECTION I.—AIR AND PRECIPITATION

Radiation Surveillance Network

April 1962

Division of Radiological Health, Public Health Service

The Public Health Service Radiation Surveillance Network (RSN) was established in 1956 in cooperation with the Atomic Energy Commission to provide a means of promptly determining increases in levels of radioactivity in air and precipitation due to fallout from nuclear weapons tests. Prior to September 1961, the Network consisted of 45 stations. Following the September 1961 resumption of nuclear weapons testing by the U.S.S.R., the Network was expanded over a period of several months to 70 stations (see figure 1).

Air

Measurements of gross beta activity of particulates in surface air are taken because they provide one of the earliest and most sensitive indications of increases of activity in the environment and thus act as an "alert" system. A direct evaluation of biological effects is not possible from these data alone.

Daily 24-hour air samples are collected by a high volume air sampler with a carbon-loaded cellulose dust filter. Field measurements with a portable survey meter enable the station operator to estimate the amount of beta activity of particulates in air at the station five hours afer collection by comparison with a known radioactive source. Each operator then reports his field estimate by telephone to the Division of Radiological Health Radiation Surveillance Center in Washington, D. C. to provide a daily national alert report. The filters are then forwarded to the central laboratory of the Radiation Surveillance Network for a more refined measurement using a thin-window gas flow proportional counter. Samples are counted 3 days after collection and re-counted 7 days later. The Way-Wigner formula ($At^{1.2}$ = constant) is employed to extrapolate to the time of collection.

The average fission-product beta concentrations in surface air during April 1962 are tabulated in table 1 and presented by means of isoconcentration contours in figure 1.

Precipitation

Continuous sampling for total precipitation is conducted at each station on a daily basis using funnels having collection areas of 0.4 square meter (m^2). One-half liter of the collected precipitation is evaporated to dryness, and the residue is forwarded to the laboratory to be counted by the same method used for analyzing the air samples. The April 1962 averages of gross beta activity in precipitation, expressed in micromicrocuries per liter ($\mu\mu c$/

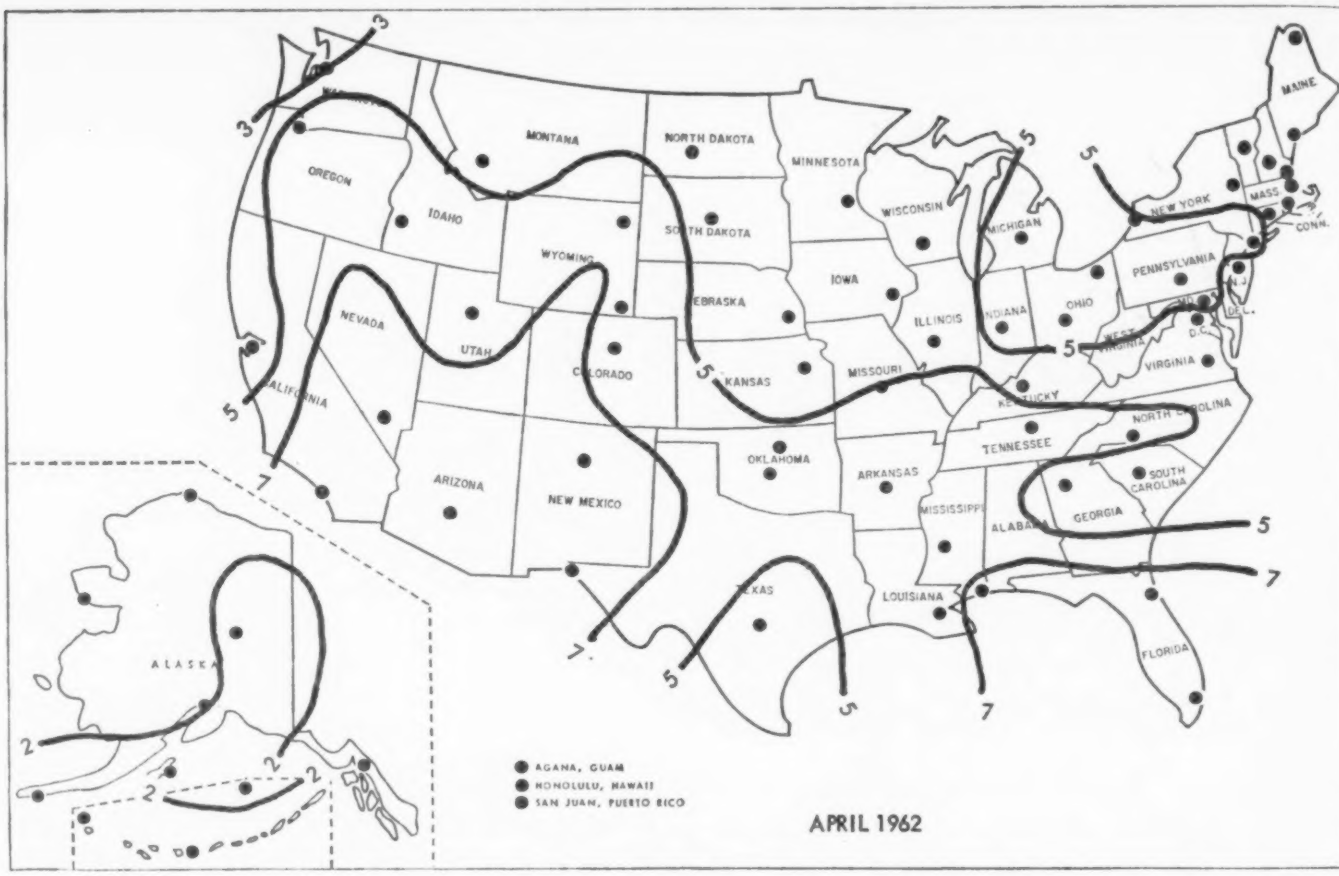

FIGURE 1.—RADIATION SURVEILLANCE NETWORK SAMPLING STATIONS AND AVERAGE FISSION PRODUCT BETA CONCENTRATIONS IN AIR ($\mu\mu c/m^3$), APRIL 1962

liter) and micromicrocuries per square meter ($\mu\mu c/m^2$), are presented in table 2.

When the gross beta concentration of a given daily precipitation sample is too low for reliable measurement, an activity ($\mu\mu c/m^2$) calculated from the minimum level of detection is included in the monthly summation of activity. Placement of a "less than" sign (<) with an average value indicates that the sum of the less than values contributing to the average is 10 percent or more of the total so that the true average is considered significantly less than the number shown.

Profiles

A chronological profile for each RSN sampling station showing the fission product beta monthly average concentrations for the period from April 1956 to December 1960 was published in the July 1961 *RHD*. Beginning with this issue, up-to-date profiles for a group of RSN stations will be presented each month, thus allowing complete network coverage each year.

The format of the profile has been changed considerably from the previous presentation. A cube-root scale was selected for the beta concentrations for several reasons. It allows representation of both low and high concentrations on one scale of limited size. The zero is retained (it is not in a log scale) and serves as a fixed datum. Higher levels are given more emphasis than with a log scale and the lower levels are given more detail than with a linear scale. Finally, the cube root scale provides a visual concept of the magnitude of beta concentrations as illustrated in the legend of figure 2.

Because the monthly detail of the profile up through December 1960 has been published, the new profiles will include such detail for 1961 and 1962 but will show only yearly averages for the years preceding 1961. In some cases the calendar year average is based on only a portion of the year. This is represented by the length and position of the dashed yearly-average line.

Table 1.—GROSS BETA ACTIVITY OF PARTICULATES IN AIR, RSN, APRIL 1962

[Concentrations in $\mu\mu c/m^3$]

City	State	Number samples	Maximum	Minimum	Average[a]	City	State	Number samples	Maximum	Minimum	Average[a]
Adak	Alaska	23	7.1	0.18	2.4	Jackson	Miss.	19	11	1.8	6.1
Anchorage	Alaska	23	3.9	0.54	2.0	Pascagoula	Miss.	20	14	1.9	7.5
Attu	Alaska	20	9.5	0.17	2.6	Jefferson City	Mo.	22	8.7	2.6	5.0
Cold Bay	Alaska	22	6.8	<0.10	2.8	Helena	Mont.	23	8.6	1.2	4.6
Fairbanks	Alaska	23	3.9	0.38	2.3	Lincoln	Nebr.	20	6.3	0.66	4.1
Juneau	Alaska	20	6.3	0.44	1.7	Las Vegas	Nev.	17	17	4.8	9.9
Kodiak	Alaska	23	4.4	0.24	2.1	Concord	N. H.	6	5.2	3.7	4.4
Nome	Alaska	22	3.6	0.15	1.6	Trenton	N. J.	21	6.3	0.70	3.9
Point Barrow	Alaska	22	3.0	0.61	1.8	Santa Fe	N. Mex.	21	21	3.5	8.5
St. Paul Island	Alaska	27	5.5	0.36	1.9	Albany	N. Y.	23	8.8	2.1	4.9
Phoenix	Ariz.	21	19	3.0	9.8	Buffalo	N. Y.	22	8.5	2.3	5.0
Little Rock	Ark.	23	14	2.3	6.1	New York	N. Y.	14	12	2.6	6.5
Berkeley	Calif.	23	12	0.62	4.2	Gastonia	N. Y.	22	9.1	2.1	6.5
Los Angeles	Calif.	22	16	2.8	7.6	Bismarck	N. D.	22	7.0	1.9	3.9
Denver	Colo.	22	8.9	3.4	6.4	Columbus	Ohio	23	12	1.8	5.4
Hartford	Conn.	24	7.1	1.8	4.5	Painesville	Ohio	6	8.0	4.0	6.5
Washington	D. C.	28	9.3	0.82	4.2	Oklahoma City	Okla.	23	10	2.7	5.9
Jacksonville	Fla.	23	12	2.6	8.0	Ponca City	Okla.	25	4.4	1.7	2.8
Miami	Fla.	23	16	1.8	7.2	Portland	Oreg.	23	17	1.2	5.6
Atlanta	Ga.	17	5.8	1.5	3.6	Harrisburg	Pa.	20	8.9	0.56	5.1
Agana	Guam	17	6.3	0.83	2.5	San Juan	P. R.	[b]—	—	—	—
Honolulu	Hawaii	22	9.0	0.64	2.4	Providence	R. I.	21	8.3	1.8	4.9
Boise	Idaho	23	12	2.3	6.0	Columbia	S. C.	21	6.6	1.6	4.6
Springfield	Ill.	21	8.7	1.8	4.7	Pierre	S. D.	29	7.2	1.8	3.8
Indianapolis	Ind.	21	12	1.9	5.3	Nashville	Tenn.	19	13	0.98	5.7
Iowa City	Iowa	23	6.6	1.3	3.8	Austin	Texas	22	9.9	0.51	4.5
Topeka	Kans.	23	8.4	0.63	4.7	El Paso	Texas	23	11	4.2	7.9
Frankfort	Ky.	23	7.4	1.9	4.2	Salt Lake City	Utah	23	10	3.1	6.0
New Orleans	La.	22	13	1.5	6.2	Barre	Vt.	17	9.2	0.82	4.9
Augusta	Maine	21	8.4	0.96	4.0	Richmond	Va.	22	6.4	2.3	4.1
Presque Isle	Maine	22	7.3	0.42	3.6	Seattle	Wash.	23	9.0	0.51	2.8
Baltimore	Md.	22	9.1	1.3	6.0	Madison	Wis.	23	7.7	0.27	4.0
Lawrence	Mass.	22	6.9	1.4	3.9	Cheyenne	Wyo.	22	8.1	2.9	6.3
Winchester	Mass.	22	7.5	1.3	4.3	Sundance	Wyo.	18	10	0.85	6.6
Lansing	Mich.	30	13	1.3	6.1						
Minneapolis	Minn.	22	6.4	0.68	3.5	Network average					4.81

[a] Weighted average obtained by summing the products of individual sampling times and the corresponding activities, and dividing by the summation of the individual sampling times.
[b] Dash denotes no data received.

Table 2.—GROSS BETA ACTIVITY IN PRECIPITATION, RSN, APRIL 1962

Station location		Average concentration ($\mu\mu c$/liter)	Total activity ($\mu\mu c/m^2$)	Station location		Average concentration ($\mu\mu c$/liter)	Total activity ($\mu\mu c/m^2$)
City	State			City	State		
Adak	Alaska	[a]—	—	Jackson	Miss.	410	89,000
Anchorage	Alaska	630	1,100	Pascagoula	Miss.	—	—
Attu	Alaska	—	—	Jefferson City	Mo.	4,000	72,000
Cold Bay	Alaska	—	—	Helena	Mont.	3,100	20,000
Fairbanks	Alaska	1,500	14,000	Lincoln	Nebr.	2,700	29,000
Juneau	Alaska	930	75,000	Las Vegas	Nev.	—	—
Kodiak	Alaska	—	—	Concord	N. H.	—	—
Nome	Alaska	—	—	Trenton	N. J.	1,000	7,200
Point Barrow	Alaska	—	—	Santa Fe	N. Mex.	11,000	45,000
St. Paul Island	Alaska	—	—	Albany	N. Y.	700	30,000
Phoenix	Ariz.	—	—	Buffalo	N. Y.	—	—
Little Rock	Ark.	1,200	96,000	New York	N. Y.	—	—
Berkeley	Calif.	3,400	20,000	Gastonia	N. C.	750	120,000
Los Angeles	Calif.	—	—	Bismarck	N. Dak.	3,200	16,000
Denver	Colo.	870	15,000	Columbus	Ohio	2,800	110,000
Hartford	Conn.	2,800	140,000	Painesville	Ohio	—	—
Washington	D. C.	1,300	100,000	Oklahoma City	Okla.	470	16,000
Jacksonville	Fla.	1,300	43,000	Ponca City	Okla.	1,600	44,000
Atlanta	Ga.	710	110,000	Portland	Oreg.	870	24,000
Agana	Guam	—	—	Harrisburg	Pa.	1,800	74,000
Honolulu	Hawaii	520	11,000	San Juan	P. R.	—	—
Boise	Idaho	420	12,000	Providence	R. I.	1,800	150,000
Springfield	Ill.	—	—	Columbia	S. C.	1,200	110,000
Indianapolis	Ind.	1,500	30,000	Pierre	S. Dak.	1,500	8,100
Iowa City	Iowa	2,400	83,000	Nashville	Tenn.	1,200	200,000
Topeka	Kans.	3,000	79,000	Austin	Tex.	1,000	90,000
Frankfort	Ky.	810	45,000	El Paso	Tex.	—	—
New Orleans	La.	1,800	150,000	Salt Lake City	Utah	1,800	99,000
Augusta	Maine	1,300	120,000	Barre	Vt.	—	—
Presque Isle	Maine	—	—	Richmond	Va.	1,000	130,000
Baltimore	Md.	700	7,000	Seattle	Wash.	1,400	29,000
Lawrence	Mass.	1,300	76,000	Madison	Wis.	2,000	55,000
Winchester	Mass.	—	—	Cheyenne	Wyo.	1,900	23,000
Lansing	Mich.	1,800	45,000	Sundance	Wyo.	—	—
Minneapolis	Minn.	1,900	48,000				

[a] Dash denotes no sample received.

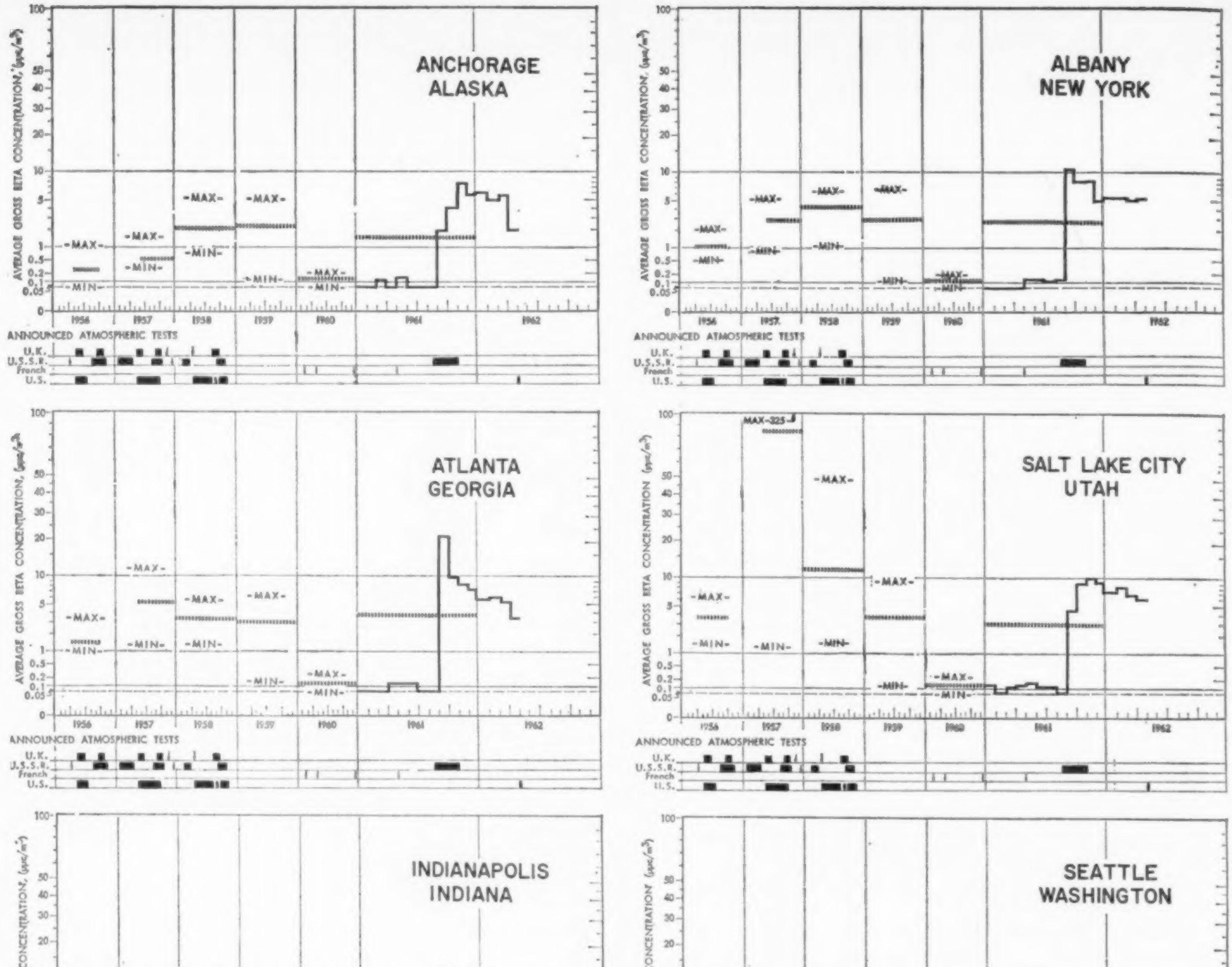

FIGURE 2.—YEARLY PROFILES OF BETA ACTIVITY IN AIR, RADIATION SURVEILLANCE NETWORK, 1956–APRIL 1962

Surface Air Radon, Thoron, and Fission Product Gross Beta Concentrations At Cincinnati, Ohio

March 26–April 20, 1962

Division of Radiological Health, Public Health Service

The determination of natural background radiation in our atmosphere is useful because the exposure levels from natural radiation can be used as a base for comparative evaluations of exposures from artificially produced radionuclides. Natural radioactivity in surface air is attributed to a number of unstable nuclides other than those produced by man. The earth's crust contains trace amounts of uranium and thorium that occur naturally and which decay through a series of their daughter products. These decay products of uranium and thorium are introduced into surface air through their rare gas daughters, radon (radon–222) and thoron (radon–220), which in turn continue to decay through the uranium and thorium series, respectively. The radon and thoron content of air depends on the escape of these rare radioactive gases from the earth. Concentrations depend on prevailing atmospheric conditions such as ambient temperature, humidity, and pressure, and on soil conditions such as moisture, porosity, and temperature.

Most of the natural radioactivity in surface air is due to radon and its daughters. Thoron and its daughters contribute much less because of thoron's short half-life and hence, a lower effective diffusion rate from the soil.

Radiological Health Research Activities, Research Branch, Division of Radiological Health, Public Health Service, performs a continuous daily sampling program at Cincinnati for radon, thoron, and gross beta fission product concentrations in surface air. The airborne particulates, which include the daughter products of radon and thoron, are collected continuously on a membrane filter surface at a rate of approximately 1.2 cubic meters of air per hour.

Radon–222 concentrations are determined from alpha measurements made immediately after the sampling period (24 to 72 hours) has ceased. Radon–222 (a.m.) concentrations have been corrected for any radon–220 daughter interferences. Radon–222 (p.m.) concentrations are derived from alpha measurements made in the afternoon (3 p.m.) approximately 7 hours after the new sampling period has begun. These values are from the same filters that are counted at 8 a.m. the following day. Radon–222 (p.m.) concentrations are uncorrected for any radon–220 daughter interferences. Radon–220 concentrations are determined from alpha measurements made on the sample used to evaluate the corrected radon–222 (a.m.) concentrations, but are counted 7 hours after the sampling period has ceased. Reported values are corrected to the time of removal of the filter. The gross beta activity of airborne particulates, when measured several days after sample collection, is due principally to artificially-produced fission products.

TABLE 1.—SURFACE AIR RADON (Rn^{222}), THORON (Rn^{220}), AND FISSION PRODUCT BETA CONCENTRATIONS, AT CINCINNATI, OHIO, MARCH 26–APRIL 20, 1962

End of sampling period	Rn^{222} 8 a.m. ($\mu\mu c/m^3$)	Rn^{222} 3 p.m. ($\mu\mu c/m^3$)	Rn^{220} ($\mu\mu c/m^3$)	Beta activity ($\mu\mu c/m^3$)
March 26	100	90	1.4	9.65
27	480	60	2.8	15.10
28	630	90	5.1	14.69
29	200	80	3.2	14.98
30	240	120	2.2	15.17
April 2	110	30	0.8	5.36
3	120	40	1.1	10.12
4	110	90	3.4	7.70
5	480	110	4.1	13.27
6	140	110	1.7	16.51
9	90	30	1.4	9.27
10	210	40	2.7	3.99
11	70	100	1.2	6.54
12	260	160	2.7	7.39
13	100	60	1.4	3.49
16	160	50	2.2	7.86
17	600	60	5.7	10.09
18	210	50	3.1	10.18
19	170	50	4.1	4.18
20	140	60	2.7	4.20
Average	197	67	2.3	9.07
Range of counting errors (2σ):				
Maximum	44	22	0.8	0.24
Minimum	15	9	0.3	0.08

The data are computed by an electronic data processing system which is programmed for thirteen four-week periods per calendar year. The data for the period March 26–April 20, 1962 appear in table 1.

REFERENCE

Setter, L. R. and G. I. Coats "The Determination of Airborne Radioactivity," *American Industrial Hygiene Association Journal, 22:* 64–69 (Feb. 1961).

Radioactivity Measurements In Surface Air Near The 80th Meridian (West)

March 1962

U.S. Naval Research Laboratory

Radioactivity measurements of surface air samples collected at various sites near the 80th Meridian (West) have been made since 1956. Sampling locations are shown in figure 1. This program is operated by the U. S. Naval Research Laboratory (NRL) with the cooperation of interested agencies of the United States, Canada, Ecuador, Peru, Bolivia, and Chile, which make the actual sample collections and forward them to NRL for analysis. Partial financial support of this program is provided by the Division of Biology and Medicine, U.S. Atomic Energy Commission.

The sampling procedure involves drawing air continuously for a seven-day period at a rate of approximately 1200 cubic meters per day through high efficiency filters, 8 inches in diameter, using positive displacement blowers. After a sample is removed, it is forwarded immediately to NRL for assay of gross beta activity two weeks after collection.

FIGURE 1.(*right*)—ATMOSPHERIC RADIOACTIVITY SAMPLING STATIONS NEAR THE 80TH MERIDIAN (WEST)

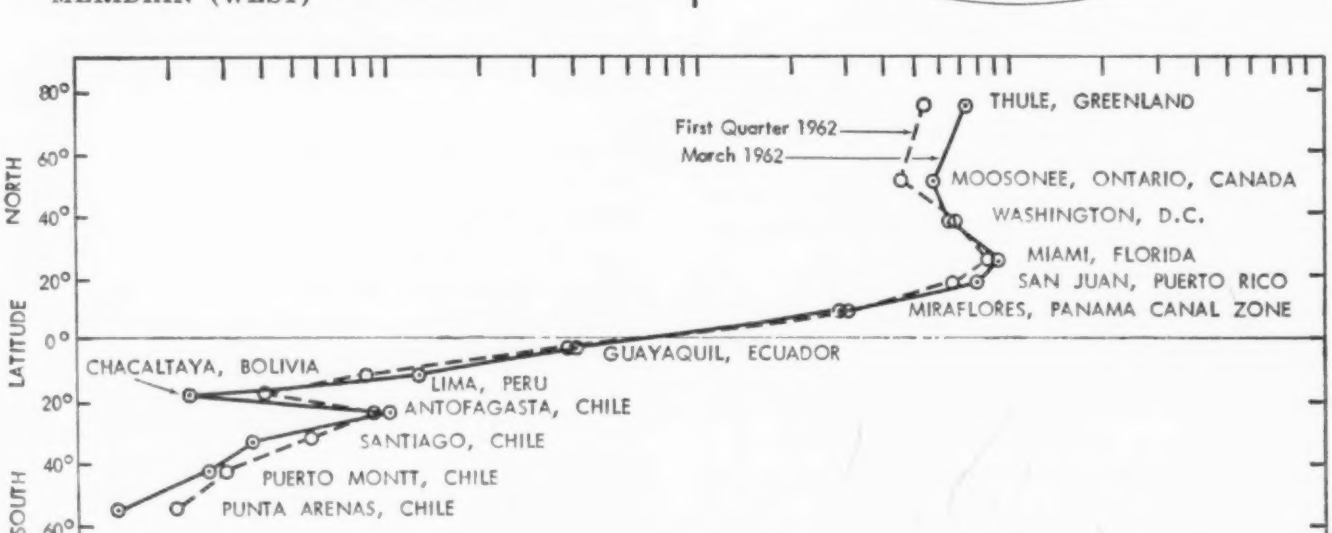

FIGURE 2.—PROFILE OF BETA ACTIVITY, AVERAGE MEASUREMENT OF SURFACE AIR AT STATIONS NEAR THE 80TH MERIDIAN (WEST), MARCH 1962

TABLE 1.—FISSION PRODUCT GROSS BETA ACTIVITY IN SURFACE AIR, MARCH 1962, NRL[a]

[Average concentrations in $\mu\mu c/m^3$]

<table>
<tr><th>Day</th><th>Punta Arenas, Chile</th><th>Puerto Montt, Chile</th><th>Santiago, Chile</th><th>Anto-fagasta, Chile</th><th>Chacal-taya, Bolivia</th><th>Lima, Peru</th><th>Guaya-quil, Ecuador</th><th>Mira-flores, Panama Canal Zone</th><th>San Juan, P. R.</th><th>Mauna Loa, Hawaii[b]</th><th>Miami, Florida</th><th>Wash-ington, D. C.</th><th>Moosonee, Ontario, Canada</th><th>Thule, Green-land</th></tr>
<tr><td>1</td><td rowspan="5">0.028</td><td rowspan="5">0.026</td><td rowspan="5">0.028</td><td rowspan="6">0.137</td><td rowspan="5">0.034</td><td rowspan="5">0.109</td><td rowspan="5">0.698</td><td rowspan="5">2.68</td><td rowspan="5">7.30</td><td rowspan="5">6.08</td><td rowspan="5">4.34</td><td rowspan="5">5.85</td><td rowspan="5">5.54</td><td rowspan="6">8.38</td></tr>
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<tr><td>25</td></tr>
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<tr><td>27</td><td rowspan="5">0.014</td><td rowspan="5">0.030</td><td rowspan="5">0.039</td><td rowspan="5">0.068</td><td rowspan="5">0.014</td><td rowspan="5">0.098</td><td rowspan="5">0.158</td><td rowspan="5">3.20</td><td rowspan="5">6.08</td><td rowspan="5">8.92</td><td rowspan="5">10.5</td><td rowspan="5">11.0</td><td rowspan="5">4.78</td></tr>
<tr><td>28</td><td rowspan="4">4.60</td></tr>
<tr><td>29</td></tr>
<tr><td>30</td></tr>
<tr><td>31</td></tr>
<tr><td>Weighted average</td><td>0.014</td><td>0.027</td><td>0.037</td><td>0.100</td><td>0.023</td><td>0.127</td><td>0.396</td><td>2.84</td><td>7.93</td><td>5.95</td><td>9.01</td><td>6.40</td><td>5.77</td><td>7.21</td></tr>
</table>

[a] The average concentration determined from a given sample is placed at the center of a rectangle which indicates the length and dates of the sampling period. Station averages for the month were determined by weighting the sample averages according to the number of days in the sampling period or that portion of the sampling period occurring in March 1962.
[b] Mauna Loa data has been included for comparison with Chacaltaya, Bolivia. Both are high elevation stations (3400 and 5200 meters) and about equally distant north and south of the equator.
[c] Dash indicates sample was not received.

The fission product concentrations in air during March 1962 are presented in table 1, and the radioactivity profile along the 80th Meridian (West) for the same month is shown in figure 2. Radioactivity concentrations in the Northern Hemisphere are not appreciably different from those existing in March 1959 during a similar period of heavy stratospheric fallout of debris from the U.S.S.R. Arctic tests. There is clear evidence that some of the radioactivity from Arctic tests does pass into the Southern Hemisphere; however, activity levels there were less than in 1959 because, as of March 1962, there had been no contribution of debris from U.S. tests since held in the tropical regions of the Pacific Ocean.

National Air Sampling Network

First Quarter 1962

Division of Air Pollution, Public Health Service

The Public Health Service developed its National Air Sampling Network in 1953 to secure basic data on the nature and extent of air pollution throughout the United States, and to detect trends in levels of pollution with respect to time, location, population density, climate, and other factors associated with air quality.

The current basic network consists of 103 sampling stations operating every year in 66 large cities and 37 nonurban areas. In addition to these every-year stations, 126 cities have stations which operate every other year. Thus, there are 229 sampling stations in all, of which about 166 are active in any given year. A list of National Air Sampling Network Stations appeared in the May 1960 issue of *Radiological Health Data.*

The network stations are manned by cooperating Federal, State, and local agencies. Twenty-four hour samples of suspended particulate matter representing approximately 2000 cubic meters of air are collected on glass fiber filters on a bi-weekly random sampling schedule. The analyses of these samples include the measurement of total quantity of suspended particulate matter, the organic matter soluble in benzene, and gross beta radioactivity. Selected samples are analyzed also for nitrates and sulfates, and for a number of metals.

Gross Beta Activity in Air

Gross beta activity data by states, for the years 1953 through 1958, were submitted by the Division of Radiological Health, Public Health Service, in testimony before the Joint Committee on Atomic Energy Hearing on Fallout from Nuclear Weapons Tests (v), Volume I, May 1959, pages 173–185. Subsequent data have been published quarterly in *Radiological Health Data* beginning with the October 1960 issue. First quarter 1962 data are presented in table 1.

Gross Beta Activity In Precipitation

During 1959 a precipitation collection and analysis program was established by the Weather Bureau Research Station in Cincinnati, Ohio, and the National Air Sampling Network. The collection stations are located at Weather Bureau offices or airport stations. Monthly composite samples of precipitation are collected at 30 stations (see figure 1) and forwarded to the Network laboratory for analysis. A list of these precipitation collection stations is given below. Samples are analyzed for total solids and a large number of metals and nonmetals. In addition, samples representing 85 percent or more of the total precipitation recorded at the collecting stations are analyzed for fission product gross beta radioactivity if a large enough volume remains after the requirements for the chemical analysis have been met. First quarter 1962 data are presented in table 2.

REFERENCE

Setter, L. R., Zimmer, C. E., Licking, D. S., and Tabor, E. C., "Air-Borne Particulate Beta Radioactivity Measurements of the National Air Sampling Network, 1953–1959," *American Industrial Hygiene Association Journal, 22:* 192–200 (June 1961).

TABLE 1.—FISSION PRODUCT GROSS BETA ACTIVITY IN SURFACE AIR, NASN, FIRST QUARTER 1962

[Concentrations in $\mu\mu c/m^3$]

Station location		Number of samples	Minimum	Maximum	Average
City or county	State				
Birmingham	Ala.	7	3.8	13.0	8.4
Mobile	Ala.	7	2.3	16.6	7.9
Anchorage	Alaska	6	3.1	11.1	7.3
Pt. Woronzof	Alaska*	6	6.3	17.6	9.3
Grank Canyon Pk.	Ariz*	7	3.8	23.8	13.5
Maricopa Co.	Ariz*	7	7.5	20.1	13.7
Phoenix	Ariz	6	9.0	21.6	15.6
Tucson	Ariz	7	8.8	18.0	13.6
Little Rock	Ark	6	5.2	15.6	7.5
Montgomery Co	Ark*	5	1.7	15.6	7.8
Burbank	Calif	2	4.4	5.9	5.2
Fresno	Calif	7	4.1	23.3	8.6
Humboldt County	Calif*	6	1.3	9.7	5.4
Los Angeles	Calif	5	4.5	17.0	10.4
Oakland	Calif	7	1.4	11.2	6.1
Pasadena	Calif	6	4.2	14.2	9.5
Richmond	Calif	5	2.6	11.5	6.2
Sacramento	Calif	7	2.8	19.6	7.8
San Diego	Calif	6	4.6	15.6	9.7
San Francisco	Calif	7	3.6	25.5	11.7
Santa Barbara	Calif	6	5.5	21.4	11.3
Denver	Col	5	1.2	9.7	5.5
Montezuma County	Col*	7	7.8	17.2	10.8
Bridgeport	Conn	7	3.3	13.3	7.1
Hartford	Conn	7	4.1	10.3	7.5
New Haven	Conn	7	.9	9.1	5.8
Stamford	Conn	7	3.1	9.5	7.1
Kent County	Del*	4	1.9	13.3	7.4
Wilmington	Del	5	.8	6.9	4.9
Washington	D. C	6	3.2	12.0	7.0
Florida Keys	Fla*	7	4.2	9.4	7.1
Jacksonville	Fla	7	3.3	11.8	7.2
St. Petersburg	Fla	3	2.5	13.2	9.1
Tampa	Fla	6	6.0	14.1	10.2
Atlanta	Ga	7	2.0	10.8	6.2
Columbus	Ga	7	3.0	15.1	8.8
Macon	Ga	6	4.4	14.2	8.0
Honolulu	Hawaii	7	3.2	9.6	6.3
Kahaluu	Hawaii*	7	1.7	11.3	4.4
Boise	Idaho	7	2.5	11.1	6.1
Butte County	Idaho*	4	3.7	11.8	8.2
Chicago	Ill	6	4.6	9.1	6.1
Cicero	Ill	7	4.0	10.4	6.6
Peoria	Ill	7	4.0	9.3	7.1
Springfield	Ill	6	5.3	9.2	7.2
East Chicago	Ind	5	4.2	6.5	5.4
Evansville	Ind	6	3.0	10.1	6.0
Fort Wayne	Ind	5	2.0	7.1	5.8
Gary	Ind	7	3.8	9.5	6.7
Indianapolis	Ind	7	7.3	12.7	8.6
Montgomery Co	Ind*	7	6.4	10.6	8.4
Clayton County	Iowa*	6	5.1	11.0	8.0
Des Moines	Iowa	6	2.5	9.7	6.0
Kansas City	Kansas	7	1.4	10.8	6.0
Wichita	Kansas	6	3.7	16.1	8.4
Louisville	Ky	5	4.7	13.8	8.3
Baton Rouge	La	6	5.2	25.7	13.2
Lake Charles	La	7	2.3	12.6	7.3
New Orleans	La	7	2.8	11.0	6.8
Acadia Nat Pk	Maine*	7	2.7	13.9	8.1
Portland	Maine	6	3.3	11.1	6.7
Baltimore	Md	7	.9	9.8	5.2
Calvert County	Md*	6	5.8	11.8	8.3
Boston	Mass	6	1.1	15.2	8.7
Fall River	Mass	5	3.6	11.6	7.8
Lawrence	Mass	7	4.5	14.3	8.9
Lynn	Mass	7	1.3	17.1	6.2
Quincy	Mass	5	7.2	16.5	10.8
Somerville	Mass	7	5.7	17.6	10.8
Springfield	Mass	7	1.4	11.5	5.9
Detroit	Mich	6	1.8	12.1	6.1
Grand Rapids	Mich	5	3.5	9.2	6.0
Kalamazoo	Mich	7	4.5	14.6	8.4
Lansing	Mich	7	3.9	11.0	7.2
Saginaw	Mich	7	3.2	8.6	6.1
Minneapolis	Minn	7	3.0	12.3	7.0
St. Paul	Minn	6	4.0	11.7	6.8
Jackson	Miss	7	4.9	12.8	8.5
Jackson County	Miss*	6	2.8	15.4	8.1
Kansas City	Mo	7	1.4	8.8	6.4
Shannon County	Mo*	6	8.3	14.2	11.5
St Louis	Mo	6	3.5	10.5	6.9
Glacier Nat Pk	Mont*	7	1.4	13.6	6.4
Helena	Mont	6	2.4	11.0	7.0
Lincoln	Neb	6	5.5	13.2	7.9
Omaha	Neb	7	1.9	9.6	6.3
Thomas County	Neb*	6	6.0	16.0	10.1
Las Vegas	Nev	6	7.1	26.0	15.1
White Pine Co	Nev*	6	4.3	12.1	8.7
Coos County	N. H*	6	4.5	10.0	6.1
Manchester	N. H	1	1.8	1.8	1.8
Camden	N. J	7	3.2	12.7	8.3
East Orange	N. J	6	4.0	9.3	6.0
Elizabeth	N. J	5	1.4	10.6	6.3
Newark	N. J	7	3.7	10.0	6.4
Trenton	N. J	6	1.5	12.8	8.6
Albuquerque	N. M	5	5.1	15.7	9.6
Colfax County	N. M*	6	3.1	16.5	8.5
Cape Vincent	N. Y*	6	5.5	12.8	7.7
Elmira	N. Y	7	2.8	17.7	6.7
Glen Cove	N. Y	4	7.3	25.2	14.1
Massena	N. Y	7	3.1	10.9	6.5
Mt. Vernon	N. Y	7	5.1	12.1	8.7
New Rochelle	N. Y	5	4.8	11.1	7.8
New York	N. Y	6	1.8	11.9	6.4
Rochester	N. Y	7	4.7	14.1	9.0
Troy	N. Y	5	4.4	20.4	11.8
Asheville	N. C	7	2.7	11.1	8.7
Cape Hatteras	N. C*	6	5.1	13.7	9.8
Charlotte	N. C	7	4.7	12.1	8.6
Winston Salem	N. C	7	2.2	14.7	8.7
Bismarck	N. D	6	3.7	8.4	5.8
Ward County	N. D*	7	3.7	9.6	5.9
Akron	Ohio	7	1.6	12.2	6.7
Cincinnati	Ohio	7	1.9	9.1	5.3
Cleveland	Ohio	5	4.6	14.0	8.2
Columbus	Ohio	7	4.9	20.5	10.7
Dayton	Ohio	7	1.6	6.9	4.1
Lorain	Ohio	6	5.0	11.6	8.4
Springfield	Ohio	6	4.1	8.7	6.4
Toledo	Ohio	6	3.0	10.7	7.3
Youngstown	Ohio	6	3.2	10.4	6.8
Cherokee County	Okla*	7	4.2	13.1	8.7
Oklahoma City	Okla	3	5.9	8.5	7.3
Tulsa	Okla	6	2.6	8.2	6.4
Curry County	Oreg*	3	3.9	7.2	5.2
Portland	Oreg	6	3.0	16.2	7.6
Clarion County	Pa*	6	4.6	12.6	7.9
Harrisburg	Pa	5	.3	10.6	6.1
Lancaster	Pa	7	1.9	11.7	8.0
Philadelphia	Pa	5	.6	9.7	6.0
Pittsburgh	Pa	7	4.8	10.7	7.3
Reading	Pa	7	.3	11.8	7.7
Wilkes Barre	Pa	7	.4	12.9	6.9
Loquillo Mtns	P. R*	6	2.8	9.1	5.8
San Juan	P. R*	6	4.4	10.5	7.6
Providence	R. I	7	.5	8.9	4.3
Washington County	R. I*	5	1.3	7.8	4.4
Columbia	S. C	7	9.1	13.7	11.2
Greenville	S. C	6	4.7	15.5	9.3
Richland County	S. C*	6	3.2	11.7	7.0

TABLE 1.—FISSION PRODUCT GROSS BETA ACTIVITY IN SURFACE AIR, NASN, FIRST QUARTER 1962

[Concentrations in $\mu\mu c/m^3$]

Station location: City or county	Station location: State	Number of samples	Minimum	Maximum	Average
Black Hills Forest	S. D*	6	4.6	14.5	9.2
Sioux Falls	S. D	6	3.7	11.0	7.1
Chattanooga	Tenn	7	2.8	9.4	5.5
Memphis	Tenn	7	3.7	12.8	8.9
Nashville	Tenn	6	1.2	20.6	10.1
Arkansas County	Texas*	5	6.9	13.1	10.0
Corpus Christi	Tex	7	2.4	17.6	9.2
Dallas	Tex	7	5.0	18.0	9.4
El Paso	Tex	6	8.7	21.0	14.0
Ft Worth	Tex	7	3.6	15.7	8.9
Houston	Tex	7	2.8	16.1	8.5
San Antonio	Tex	6	3.3	14.7	6.0
Waco	Tex	6	2.9	14.2	8.5
Salt Lake City	Utah	6	3.5	11.9	7.3
Burlington	Vt	6	3.9	11.3	7.3
Orange County	Vt*	6	4.4	6.8	5.6
Danville	Va	7	6.5	14.5	9.7
Norfolk	Va	7	5.5	14.9	9.9
Shenandoah Nat Pk	Va*	6	8.3	12.9	10.2
Clallam County	Wash*	4	2.1	8.2	5.3
Seattle	Wash	6	3.6	10.5	7.2
Tacoma	Wash	3	1.9	14.3	9.3
Charleston	W. Va	6	3.3	11.2	8.1
Huntington	W. Va	5	.7	10.7	5.7
Door County	Wis*	5	2.4	10.1	5.4
Milwaukee	Wis	6	3.4	7.9	4.7
Racine	Wis	5	1.6	6.9	3.7
Cheyenne	Wyo	6	4.3	21.5	11.4
Yellowstone Pk	Who	6	4.7	30.8	11.4
Network average					7.85

* Nonurban Station.

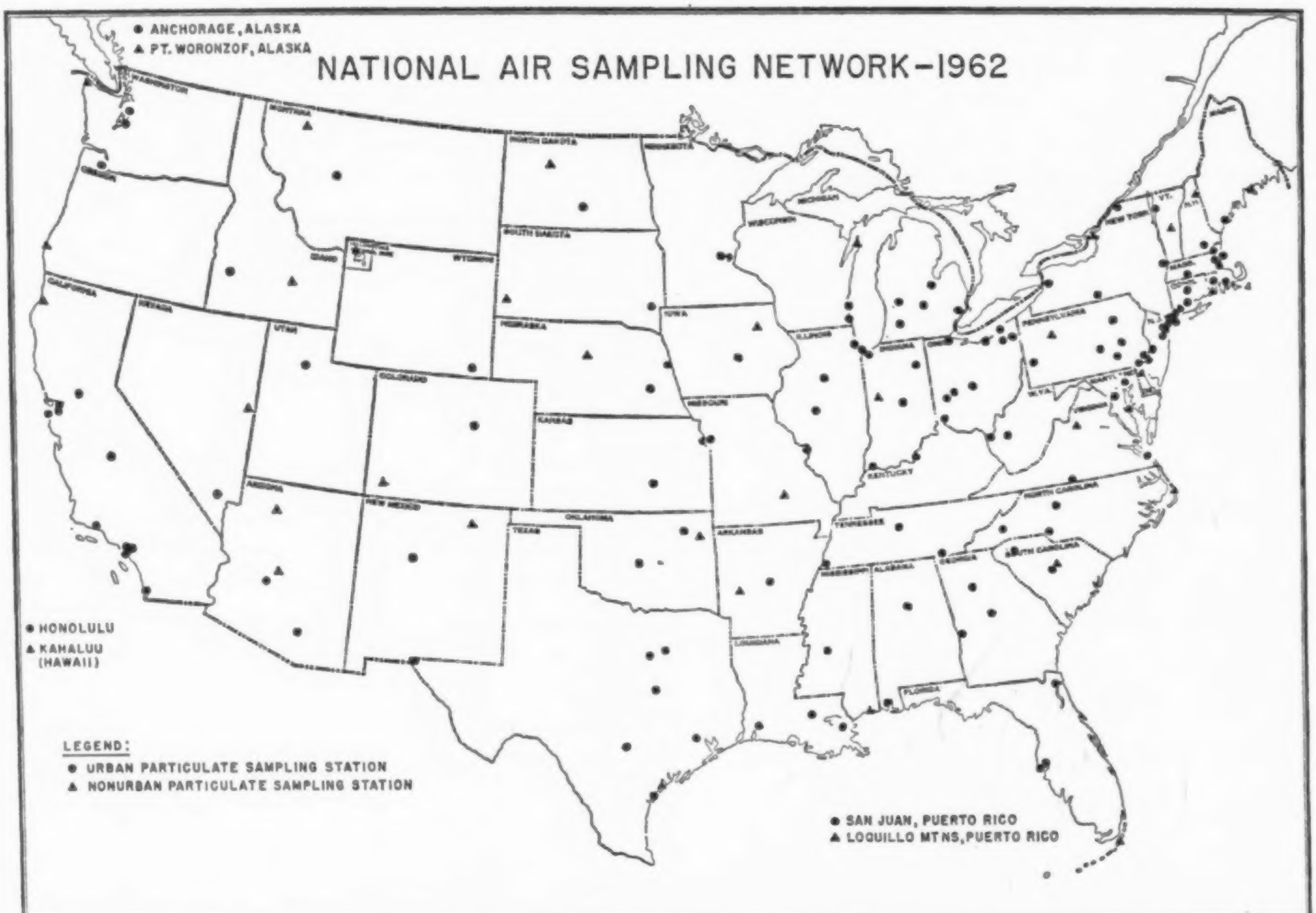

FIGURE 1.—NATIONAL AIR SAMPLING NETWORK SAMPLING STATIONS, 1962

TABLE 2.—FISSION PRODUCT BETA ACTIVITY IN PRECIPITATION, FIRST QUARTER 1962

Station	January		February		March	
	μμc/liter	μμc/m²	μμc/liter	μμc/m²	μμc/liter	μμc/m²
Montgomery, Ala.	444	51,500	204	10,500	1205	231,000
Santa Maria, Calif.	314	14,500	120	23,200	—	—
Tampa, Fla.	—	—	—	—	1255	100,000
Chicago (Midway), Ill.	557	51,800	533	28,000	3270	162,000
Lake Charles, La.	156	17,800	—	—	—	—
Nantucket, Mass.	304	32,500	420	51,000	—	—
Sault St. Marie, Mich.	1054	40,500	80	4,900	—	—
St. Cloud, Minn.	—	—	140	5,400	—	—
Columbia, Miss.	—	—	350	14,700	860	46,000
Albany, N. Y.	—	—	435	33,400	1216	68,000
Cape Hatteras, N. C.	189	32,500	—	—	1300	146,000
Cincinnati, (Airport), Ohio	559	32,600	272	31,200	920	81,000
Cincinnati, (WBRS), Ohio	—	—	86	10,800	1270	109,000
Philadelphia, Pa.	759	42,500	460	29,800	790	52,000
Charleston, S. C.	418	23,800	—	—	750	144,000
Greenville, S. C.	861	96,400	416	48,600	1340	258,000
Nashville, Tenn.	383	59,000	95	18,800	910	125,000
Sterling, Va. (Washington, D. C.)	466	17,900	400	37,200	530	61,000
Tatoosh Island, Wash.	631	92,400	300	22,500	730	100,000

PRECIPITATION COLLECTION STATIONS

Alabama: Montgomery
California: Santa Maria
Colorado: Grand Junction
Florida: Tampa
Idaho: Pocatello
Illinois:
- Chicago (Midway Airport)
- Chicago (O'Hare Airport)

Louisiana: Lake Charles
Maine: Caribou
Maryland: Silver Hill
Massachusetts: Nantucket
Michigan: Sault Ste. Marie
Minnesota: St. Cloud
Missouri: Columbia
Montana: Glasgow
Nebraska: Grand Island
Nevada: Las Vegas
New York: Albany
North Carolina: Cape Hatteras
Ohio:
- Cincinnati (research station)
- Cincinnati (airport)

Pennsylvania: Philadelphia
South Carolina:
- Charleston
- Greenville

Tennessee: Nashville
Texas:
- Brownsville
- San Angelo
- Amarillo

Virginia: Sterling
Washington: Tatoosh Island

SECTION II.—FOOD

Radionuclides In Institutional Diet Samples

January 1961–February 1962

Division of Radiological Health, Public Health Service

The determination of radionuclide concentrations in the diet constitutes an important element of an integrated program of environmental radiation surveillance and assessment. In recognition of the potential significance of the diet in the total picture of environmental radiation, the Public Health Service in 1961 initiated its Institutional Diet Sampling Program. This program is being administered by the Division of Radiological Health with the assistance of the Service's Division of Environmental Engineering and Food Protection.

The program is designed to estimate the dietary intake of radionuclides in a controlled population group ranging from children to young adults of school age. Initially, the program consisted of sampling diets in eight institutions, but it has since been expanded to include 20 boarding schools or institutions, geographically distributed as shown in figure 1. Institutions selected include both exclusive, well-funded boarding schools to orphanages with severe economic limitations. Each institution (sampling point) is located in a community participating in the Pasteurized Milk Monitoring Program and the Drinking Water Analysis Program. The analytical data from these two activities are used to supplement the findings from the Institutional Diet Sampling Program.

Sampling Procedure

In general, the sampling procedure is the same in each case. Each sample represents the edible portion of the diet for a full 7-day week

FIGURE 1.—INSTITUTIONAL DIET SAMPLING LOCATIONS, FEBRUARY 1962

(21 meals plus soft drinks, candy bars, or other in-between snacks obtained by duplicating the meals of a different individual each day). Each institution supplies one total 7-day, 21-meal diet sample each month. Meals are frozen following collection. On completion of

the total sample, it is packed in dry ice and shipped by air express to either the Southwestern Radiological Health Laboratory at Las Vegas, Nevada, the Southeastern Radiological Health Laboratory at Montgomery, Alabama, or the Northeastern Radiological Health Laboratory at Winchester, Massachusetts. Samples usually range in volume from 6 to 16 liters and weigh from 8 to 20 kilograms.

A record of the components of each meal and the approximate meal weight is maintained by the institution's dietician. This record and a menu are sent in with each sample.

Analytical Program

Total weight, ash, and moisture determinations, as well as stable calcium and potassium, are obtained by conventional gravimetric or spectrophotometric methods. Phosphate determinations are made by colorimetric technique. Calcium and phosphorus determinations were included in the analytical program because calcium or phosphorus compounds may have an effect on the uptake of important bone-seeking radionuclides such as strontium–89 and 90.

The radionalysis program is designed around three basic procedures: (1) gamma spectroscopy, (2) chemical separation of strontium–89 and 90 with subsequent counting, and (3) total radium analysis. In the absence of interference, other than naturally-occurring radioactive potassium (K^{40}), minimum detectable concentrations for the gamma scan on a per-kilogram basis are: I^{131}, 10 $\mu\mu c$/kg; Cs^{137}, 5 $\mu\mu c$/kg; and Ba^{140}, 10 $\mu\mu c$/kg. Approximate minimum detectable concentrations for Sr^{89} and Sr^{90} are 5 and 1 $\mu\mu c$/kg respectively. The minimum detectable concentration for total radium during 1961 was about 5 $\mu\mu c$/kg and has been reduced to 1 $\mu\mu c$/kg beginning with the January 1962 data.

Total radium is determined by ashing, separation, and coprecipitation of radium and barium sulphate or chromate. After transfer to planchets, alpha activity is measured by an internal proportional counter with an appropriate delay for checking ingrowth of radium daughters. The total radium technique is a practical screening indicator. Other naturally occurring radionuclides may contribute to the reported total radium values. The bone dose calculated by assuming radium–226 at about 30 percent of the total radium is therefore a moderately high value. Future plans call for the acquisition of special equipment to perform specific determinations of radium–226.

Data Treatment

Tables 1 through 4 present the dietary intake data expressed on a per-day basis from the beginning of the program in January 1961 to February 1962. These four tables group the data as follows: (1) total weight, water, and ash; (2) calcium, phosphate, and potassium; (3) strontium–89, strontium–90, and total radium; and (4) iodine–131, cesium–137, and barium–140.

Certain of the radioanalyses are reported by the laboratories as being non-detectable (ND) or "less than" (<) a specified value. For this reason, special treatment of the data was required for the calculation of meaningful averages. The data prior to September 1961 was treated differently than that after September due to the arrival of fresh fission product activity sometime after September 15, 1961, from the U.S.S.R. nuclear test series, which began September 1.

During January-September 1961, strontium–89, iodine–131, and barium–140 data, when presented as being ND, were assumed to be equal to zero for averaging purposes. The half-lives of these three radionuclides are sufficiently short so that they would have decayed to insignificant amounts during the testing moratorium. On the other hand, cesium–137 has a sufficiently long half-life and was averaged with its full "less than" values.

During September 1961–February 1962, strontium–89, iodine–131, and barium–140 data, when presented as being "less than" were assumed to be equal to the full "less than" values when averaging. All other data (strontium–90, total radium, and cesium–137), whether before or after the resumption of testing, were assumed to be equal to the full "less than" value when averaging.

The placement of a "less than" sign (<) in front of an average was dependent upon the following rule: If the sum of the "less than" values is equal to or greater than 20 percent of the total sum, the true average is assumed

(Continued on page 242)

TABLE 1.—TOTAL WEIGHT, WATER AND

[Based on 7-day

Station location	January 1961			February 1961			March 1961		
	Total weight kg/day	Water kg/day	Ash gm/day	Total weight kg/day	Water kg/day	Ash gm/day	Total weight kg/day	Water kg/day	Ash gm/day
Alaska Palmer	[a]—	—	—	—	—	—	—	—	—
California Los Angeles	—	—	—	1.54	—	13.4	2.58	—	16.2
Colorado Denver	1.01	—	8.85	1.83	—	17.6	2.08	—	24.0
Florida Tampa	—	—	—	—	—	—	—	—	—
Georgia Atlanta	—	—	—	—	—	—	1.73	—	18.4
Hawaii Honolulu	—	—	—	—	—	—	—	—	—
Illinois Chicago	—	—	—	—	—	—	—	—	—
Ohio Cleveland	—	—	—	—	—	—	—	—	—
Louisiana New Orleans	—	—	—	—	—	—	—	—	—
Massachusetts Boston	—	—	—	—	—	—	—	—	—
Missouri St. Louis	1.77	—	14.9	2.30	—	22.7	1.88	—	21.0
Montana Helena	—	—	—	—	—	—	—	—	—
Nebraska Omaha	—	—	—	—	—	—	—	—	—
New Mexico Albuquerque	—	—	—	—	—	—	—	—	—
New York New York	1.51	—	15.0	1.21	—	10.3	1.08	—	11.3
Tennessee Memphis	—	—	—	—	—	—	—	—	—
Texas Austin	—	—	—	2.41	—	21.7	2.44	—	26.4
Utah Salt Lake City	—	—	—	—	—	—	—	—	—
Virginia Norfolk	—	—	—	—	—	—	—	—	—
Washington Seattle	—	—	—	2.21	—	21.0	2.63	—	19.7
Averages	1.43	—	12.9	1.92	—	17.8	2.06	—	19.6

[a] Dash indicates no samples collected.
[b] Data discarded because of sample leakage in shipment or sampling errors.

ASH OF INSTITUTIONAL DIET SAMPLES

composite samples]

April 1961			May 1961			June 1961			July 1961		
Total weight kg/day	Water kg/day	Ash gm/day	Total weight kg/day	Water kg/day	Ash gm/day	Total weight kg/day	Water kg/day	Ash gm/day	Total weight kg/day	Water kg/day	Ash gm/day
—	—	—	—	—	—	—	—	—	—	—	—
1.71	1.31	14.3	1.71	1.31	14.3	1.70	1.27	7.4	0.77	0.57	7.0
1.69	—	17.6	2.97	2.23	28.3	1.39	1.04	8.71	2.67	2.13	23.7
—	—	—	—	—	—	—	—	—	—	—	—
1.85	—	19.1	1.59	—	17.0	1.35	0.97	17.6	1.68	1.33	13.7
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	1.59	—	15.7	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
2.28	—	25.1	1.70	1.33	12.9	3.21	2.51	29.1	2.64	2.01	30.4
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
(b)	(b)	(b)	1.45	1.03	15.4	1.63	1.23	14.3	(b)	(b)	(b)
—	—	—	—	—	—	—	—	—	—	—	—
2.47	—	23.6	2.10	1.54	21.8	2.47	1.77	26.6	2.40	1.78	23.4
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
2.41	—	24.1	2.16	1.66	21.8	2.43	1.90	21.1	1.97	1.54	19.3
2.07	1.31	20.6	1.91	1.52	18.4	2.02	1.53	17.8	2.02	1.56	19.6

TABLE 1.—TOTAL WEIGHT, WATER, AND

[Based on 7-day

Station location	August 1961			September 1961			October 1961		
	Total weight kg/day	Water kg/day	Ash gm/day	Total weight kg/day	Water kg/day	Ash gm/day	Total weight kg/day	Water kg/day	Ash gm/day
Alaska Palmer	[a]—	—	—	—	—	—	1.63	1.27	14.7
California Los Angeles	1.34	1.13	9.4	1.96	1.71	20.3	1.36	1.14	14.9
Colorado Denver	2.67	2.08	29.1	2.48	2.08	24.8	1.94	1.47	19.4
Florida Tampa	—	—	—	—	—	—	2.24	1.61	27.4
Georgia Atlanta	1.67	1.37	9.3	1.14	0.79	12.4	1.52	1.04	13.7
Hawaii Honolulu	—	—	—	—	—	—	—	—	—
Illinois Chicago	—	—	—	b	b	b	1.78	1.36	19.7
Ohio Cleveland	—	—	—	—	—	—	—	—	—
Louisiana New Orleans	—	—	—	—	—	—	—	—	—
Massachusetts Boston	—	—	—	—	—	—	1.96	1.27	19.7
Missouri St. Louis	—	—	—	b	b	b	2.71	1.93	27.1
Montana Helena	—	—	—	—	—	—	—	—	—
Nebraska Omaha	—	—	—	—	—	—	—	—	—
New Mexico Albuquerque	—	—	—	—	—	—	—	—	—
New York New York	1.30	0.91	15.1	1.25	0.90	11.3	1.32	0.91	13.1
Tennessee Memphis	—	—	—	—	—	—	1.82	1.20	17.7
Texas Austin	2.60	1.90	25.1	2.73	1.97	26.4	2.73	1.97	25.7
Utah Salt Lake City	—	—	—	—	—	—	—	—	—
Virginia Norfolk	—	—	—	—	—	—	—	—	—
Washington Seattle	2.30	1.88	21.4	2.26	1.56	27.1	2.56	2.23	33.3
Averages	1.98	1.54	18.2	1.97	1.50	20.4	1.96	1.45	20.5

[a] Dash indicates no samples collected.
[b] Data discarded because of sample leakage in shipment or sampling errors.

ASH OF INSTITUTIONAL DIET SAMPLES—Continued

composite samples]

November 1961			December 1961			January 1962			February 1962		
Total weight kg/day	Water kg/day	Ash gm/day	Total weight kg/day	Water kg/day	Ash gm/day	Total weight kg/day	Water kg/day	Ash gm/day	Total weight kg/day	Water kg/day	Ash gm/day
2.24	1.37	15.7	1.87	1.37	20.7	1.16	0.80	10.4	2.01	1.74	20.1
1.56	1.16	29.6	1.36	1.10	10.9	1.86	1.16	13.0	1.27	0.97	7.63
1.70	1.26	17.0	2.24	1.79	22.4	—	—	—	1.78	1.41	16.1
1.43	9.85	12.7	—	—	—	—	—	—	—	—	—
1.34	0.96	14.3	1.73	1.21	16.9	1.79	0.51	17.3	1.39	9.02	14.8
2.01	1.53	16.1	2.21	1.70	20.0	2.20	1.63	17.6	2.24	1.69	11.2
1.53	1.19	16.9	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	1.85	1.41	17.3	1.65	1.25	16.4
—	—	—	—	—	—	1.89	1.46	17.1	2.16	14.1	20.3
2.36	1.13	24.4	—	—	—	1.67	1.23	15.3	2.10	1.61	20.8
2.73	1.97	30.0	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	1.98	1.53	21.8	—	—	—
—	—	—	—	—	—	2.31	1.86	13.9	1.70	1.29	8.50
—	—	—	—	—	—	1.40	1.06	15.4	1.24	0.89	9.92
1.45	1.11	13.1	1.26	0.89	11.6	1.13	0.81	10.7	—	—	—
2.16	1.51	23.0	1.87	1.33	19.1	2.20	1.64	20.7	2.18	1.53	19.7
2.70	1.34	25.8	2.12	1.49	20.0	2.44	1.60	27.1	1.25	0.92	11.5
2.48	2.04	19.8	1.77	1.19	14.1	1.67	1.30	13.4	1.76	1.31	12.3
—	—	—	—	—	—	1.98	1.34	21.4	1.79	0.49	20.8
2.38	1.86	26.3	2.30	1.63	23.0	3.17	2.47	28.5	3.17	2.47	28.6
2.00	2.02	20.3	1.87	1.37	17.9	1.92	1.36	17.6	1.85	2.71	15.9

TABLE 2.—CALCIUM, PHOSPHATE AND

[Based on 7-day

Station location	January 1961			February 1961			March 1961		
	Ca gm/day	PO_4 gm/day	K gm/day	Ca gm/day	PO_4 gm/day	K gm/day	Ca gm/day	PO_4 gm/day	K gm/day
Alaska Palmer	[a]—	—	—	—	—	—	—	—	—
California Los Angeles	—	—	—	0.65	—	1.54	0.80	—	1.55
Colorado Denver	0.55	—	0.51	0.88	—	1.64	1.50	—	3.75
Florida Tampa	—	—	—	—	—	—	—	—	—
Georgia Atlanta	—	—	—	—	—	—	1.00	3.84	2.43
Hawaii Honolulu	—	—	—	—	—	—	—	—	—
Illinois Chicago	—	—	—	—	—	—	—	—	—
Ohio Cleveland	—	—	—	—	—	—	—	—	—
Louisiana New Orleans	—	—	—	—	—	—	—	—	—
Massachusetts Boston	—	—	—	—	—	—	—	—	—
Missouri St. Louis	0.73	—	1.95	0.99	—	2.98	1.21	—	1.31
Montana Helena	—	—	—	—	—	—	—	—	—
Nebraska Omaha	—	—	—	—	—	—	—	—	—
New Mexico Albuquerque	—	—	—	—	—	—	—	—	—
New York New York	0.34	2.18	2.50	0.60	2.34	1.88	0.47	2.27	1.34
Tennessee Memphis	—	—	—	—	—	—	—	—	—
Texas Austin	—	—	—	1.26	5.28	3.77	1.44	6.18	3.43
Utah Salt Lake City	—	—	—	—	—	—	—	—	—
Virginia Norfolk	—	—	—	—	—	—	—	—	—
Washington Seattle	—	—	—	0.97	—	2.21	1.23	—	2.37
Averages	0.54	2.18	1.65	0.89	3.81	2.34	1.00	4.10	2.31

[a] Dash indicates no sample collected.
[b] Data discarded because of sampling errors or sample leakage in shipment.

POTASSIUM CONTENT OF INSTITUTIONAL DIET SAMPLES

composite samples]

April 1961			May 1961			June 1961			July 1961		
Ca gm/day	PO_4 gm/day	K gm/day	Ca gm/day	PO_4 gm/day	K gm/day	Ca gm/day	PO_4 gm/day	K gm/day	Ca gm/day	PO_4 gm/day	K gm/day
—	—	—	—	—	—	—	—	—	—	—	—
0.99	3.84	2.40	0.99	3.84	2.40	2.36	9.74	2.21	0.62	1.59	1.16
1.08	3.84	1.68	1.84	8.32	3.86	1.47	4.79	2.08	1.79	6.37	4.01
—	—	—	—	—	—	—	—	—	—	—	—
1.19	4.68	2.76	0.90	4.44	2.50	1.31	3.66	1.96	0.83	3.14	1.71
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	0.90	4.14	2.51	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
1.39	5.69	2.74	0.82	3.57	2.04	1.61	8.77	4.50	1.74	7.66	3.43
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
b	b	b	0.73	2.94	2.43	0.99	3.28	2.00	b	b	b
—	—	—	—	—	—	—	—	—	—	—	—
1.51	6.14	3.26	1.29	5.41	2.21	1.60	6.54	2.93	1.40	5.85	2.71
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
1.13	6.66	4.34	1.14	5.61	2.80	2.01	7.53	3.16	1.28	5.12	2.96
1.21	5.14	2.86	1.08	4.78	2.59	1.62	6.33	2.69	1.28	4.95	2.66

TABLE 2.—CALCIUM, PHOSPHATE, AND

[Based on 7-day

Station location	August 1961			September 1961			October 1961		
	Ca gm/day	PO_4 gm/day	K gm/day	Ca gm/day	PO_4 gm/day	K gm/day	Ca gm/day	PO_4 gm/day	K gm/day
Alaska Palmer	[a]—	—	—	—	—	—	0.54	2.85	2.18
California Los Angeles	0.47	2.16	2.01	1.47	5.69	2.54	0.57	3.23	2.03
Colorado Denver	2.72	7.64	2.94	1.84	6.66	3.68	0.95	4.39	2.99
Florida Tampa	—	—	—	—	—	—	1.57	6.43	2.86
Georgia Atlanta	.056	2.00	1.71	0.54	2.11	1.57	0.69	2.86	2.28
Hawaii Honolulu	—	—	—	—	—	—	—	—	—
Illinois Chicago	—	—	—	b	b	b	1.19	5.14	2.71
Ohio Cleveland	—	—	—	—	—	—	—	—	—
Louisiana New Orleans	—	—	—	—	—	—	—	—	—
Massachusetts Boston	—	—	—	—	—	—	1.37	5.00	2.43
Missouri St. Louis	—	—	—	b	b	b	1.28	6.38	4.74
Montana Helena	—	—	—	—	—	—	—	—	—
Nebraska Omaha	—	—	—	—	—	—	—	—	—
New Mexico Albuquerque	—	—	—	—	—	—	—	—	—
New York New York	1.20	4.71	2.14	0.46	2.06	2.00	0.93	2.71	1.86
Tennessee Memphis	—	—	—	—	—	—	1.06	3.86	2.43
Texas Austin	1.57	7.00	3.43	1.57	5.85	3.43	1.71	6.71	3.28
Utah Salt Lake City	—	—	—	—	—	—	—	—	—
Virginia Norfolk	—	—	—	—	—	—	—	—	—
Washington Seattle	1.31	6.07	3.21	1.92	7.36	3.16	3.27	7.23	4.08
Averages	1.30	4.93	2.57	1.30	4.95	2.73	1.26	4.73	2.82

[a] Dash indicates no samples collected.
[b] Data discarded because of sampling errors or sample leakage in shipment.

composite samples]

November 1961			December 1961			January 1962			February 1962		
Ca gm/day	PO_4 gm/day	K gm/day	Ca gm/day	PO_4 gm/day	K gm/day	Ca gm/day	PO_4 gm/day	K gm/day	Ca gm/day	PO_4 gm/day	K gm/day
0.65	3.30	3.45	0.97	5.08	2.96	0.56	2.51	1.60	1.12	4.28	2.86
1.29	6.80	2.64	0.34	2.88	2.03	0.49	3.07	2.51	0.45	1.80	2.13
0.83	4.01	2.90	1.54	5.47	3.58	—	—	—	0.15	3.87	2.68
0.76	3.28	1.86	—	—	—	—	—	—	—	—	—
0.84	4.14	1.71	0.96	4.18	2.43	1.00	4.57	2.28	0.76	3.57	1.86
0.52	3.34	2.91	0.73	4.66	3.14	0.93	4.14	2.40	0.96	2.31	2.70
0.93	3.71	2.28	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	1.36	5.14	2.28	1.27	4.43	2.86
—	—	—	—	—	—	1.23	4.57	2.28	1.16	4.43	2.86
1.94	6.00	3.86	—	—	—	1.24	4.57	2.57	1.57	5.00	2.86
1.39	6.35	4.58	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	1.27	5.55	2.53	—	—	—
—	—	—	—	—	—	1.01	3.80	3.21	0.75	1.94	2.34
—	—	—	—	—	—	0.87	3.51	1.83	0.89	2.46	1.91
0.66	3.28	2.28	0.57	2.86	1.57	0.51	2.57	1.43	—	—	—
1.39	5.00	3.28	1.14	4.14	2.71	1.26	5.43	2.86	0.99	4.28	2.86
1.81	6.71	3.57	1.40	5.24	2.86	1.47	7.00	3.00	0.73	2.57	1.57
0.87	4.95	3.36	0.64	3.76	2.88	0.80	3.64	2.46	0.80	2.77	2.61
—	—	—	—	—	—	0.80	4.43	2.86	0.90	3.86	2.14
1.46	6.82	3.81	1.11	5.38	3.20	1.84	6.65	9.58	1.64	6.81	4.60
1.10	4.84	3.04	0.94	4.36	2.74	1.04	4.45	2.77	0.94	3.62	2.59

TABLE 3.—Sr^{89}, Sr^{90} and Ra

[Based on 7-day

Station location	January 1961			February 1961			March 1961		
	Sr^{89} μμc/day	Sr^{90} μμc/day	Total Ra μμc/day	Sr^{89} μμc/day	Sr^{90} μμc/day	Total Ra μμc/day	Sr^{89} μμc/day	Sr^{90} μμc/day	Total Ra μμc/day
Alaska Palmer	[a]—	—	—	—	—	—	—	—	—
California Los Angelés	—	—	—	—	5.4	2.6	—	3.4	6.0
Colorado Denver	—	3.4	2.3	—	10.6	1.7	—	2.6	12.6
Florida Tampa	—	—	—	—	—	—	—	—	—
Georgia Atlanta	—	—	—	—	—	—	[b] ND	9.4	3.0
Hawaii Honolulu	—	—	—	—	—	—	—	—	—
Illinois Chicago	—	—	—	—	—	—	—	—	—
Ohio Cleveland	—	—	—	—	—	—	—	—	—
Louisiana New Orleans	—	—	—	—	—	—	—	—	—
Massachusetts Boston	—	—	—	—	—	—	—	—	—
Missouri St. Louis	—	13.3	6.0	—	13.1	7.3	—	4.1	7.7
Montana Helena	—	—	—	—	—	—	—	—	—
Nebraska Omaha	—	—	—	—	—	—	—	—	—
New Mexico Albuquerque	—	—	—	—	—	—	—	—	—
New York New York	ND	6.9	<2.9	ND	2.7	<2.9	ND	5.0	<2.9
Tennessee Memphis	—	—	—	—	—	—	—	—	—
Texas Austin	—	—	—	ND	8.7	<4.6	ND	10.4	<3.6
Utah Salt Lake City	—	—	—	—	—	—	—	—	—
Virginia Norfolk	—	—	—	—	—	—	—	—	—
Washington Seattle	—	—	—	—	12.6	3.7	—	5.7	2.1
Averages	ND	7.9	<3.7	ND	8.8	<3.8	ND	5.8	<5.4

[a] Dash indicates no sample collected.
[b] ND indicates concentration is below the minimum level of detection. For averaging, "ND" is assumed to be equal to zero.
[c] Data discarded because of sample leakage in shipment, or sampling errors.

CONTENT OF INSTITUTIONAL DIET SAMPLES

composite samples]

April 1961			May 1961			June 1961			July 1961		
Sr^{89} µµc/day	Sr^{90} µµc/day	Total Ra µµc/day	Sr^{89} µµc/day	Sr^{90} µµc/day	Total Ra µµc/day	Sr^{89} µµc/day	Sr^{90} µµc/day	Total Ra µµc/day	Sr^{89} µµc/day	Sr^{90} µµc/day	Total Ra µµc/day
—	—	—	—	—	—	—	—	—	—	—	—
—	4.0	5.1	—	4.0	5.1	—	<1.7	3.9	—	4.1	5.4
—	3.0	6.7	—	7.4	6.9	—	2.3	7.7	—	4.8	12.0
—	—	—	—	—	—	—	—	—	—	—	—
ND	8.7	<2.9	ND	7.0	4.0	ND	9.1	<7.9	ND	7.1	7.1
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	ND	6.4	7.4	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	7.6	10.0	—	6.0	4.7	—	<3.1	10.3	—	9.0	12.7
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
c	c	c	ND	5.0	2.9	ND	5.6	<3.6	c	c	c
—	—	—	—	—	—	—	—	—	—	—	—
ND	10.4	<3.6	ND	9.3	<7.1	ND	5.0	<10.0	ND	14.0	<10.0
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	9.9	6.6	—	3.3	3.3	—	8.3	11.8	—	2.0	8.4
ND	7.3	5.7	ND	6.0	5.2	ND	5.0	<9.2	ND	6.8	9.3

TABLE 3.—Sr^{89}, Sr^{90} and Ra

(Based on 7-day

Station location	August 1961			September 1961			October 1961		
	Sr^{89} μμc/day	Sr^{90} μμc/day	Total Ra μμc/day	Sr^{89} μμc/day	Sr^{90} μμc/day	Total Ra μμc/day	Sr^{89} μμc/day	Sr^{90} μμc/day	Total Ra μμc/day
Alaska Palmer	[a]—	—	—	—	—	—	—	8.9	1.6
California Los Angeles	—	2.1	2.1	—	8.6	5.3	—	1.4	11.0
Colorado Denver	—	10.4	8.0	—	6.7	9.1	—	12.9	1.7
Florida Tampa	—	—	—	—	—	—	<11.1	15.1	<10.0
Georgia Atlanta	[b]ND	4.7	<3.7	ND	5.1	<3.7	<7.6	7.1	<5.7
Hawaii Honolulu	—	—	—	—	—	—	—	—	—
Illinois Chicago	—	—	—	[c]	[c]	[c]	<8.9	10.3	<7.9
Ohio Cleveland	—	—	—	—	—	—	—	—	—
Louisiana New Orleans	—	—	—	—	—	—	—	—	—
Massachusetts Boston	—	—	—	—	—	—	<9.8	14.3	<7.9
Missouri St. Louis	—	—	—	[c]	[c]	[c]	—	6.9	<2.7
Montana Helena	—	—	—	—	—	—	—	—	—
Nebraska Omaha	—	—	—	—	—	—	—	—	—
New Mexico Albuquerque	—	—	—	—	—	—	—	—	—
New York New York	ND	9.3	<6.0	ND	5.6	<3.4	<6.6	3.9	<5.7
Tennessee Memphis	—	—	—	—	—	—	<9.0	13.1	<7.1
Texas Austin	ND	12.4	<10.0	ND	17.4	<7.9	<13.6	11.9	<10.0
Utah Salt Lake City	—	—	—	—	—	—	—	—	—
Virginia Norfolk	—	—	—	—	—	—	—	—	—
Washington Seattle	—	8.1	6.0	—	7.7	9.3	—	6.9	7.7
Averages	ND	8.1	<6.0	ND	8.5	<6.4	<9.5	9.4	<6.6

[a] Dash indicates no sample collected.
[b] ND indicates concentration is below the minimum level of detection. For averaging "ND" is assumed to be equal to zero.
[c] Data discarded because of sampling errors or sample leakage in shipment.

CONTENT OF INSTITUTIONAL DIET SAMPLES—Continued

composite samples)

November 1961			December 1961			January 1962			February 1962		
Sr^{89} μμc/day	Sr^{90} μμc/day	Total Ra μμc/day	Sr^{89} μμc/day	Sr^{90} μμc/day	Total Ra μμc/day	Sr^{89} μμc/day	Sr^{90} μμc/day	Total Ra μμc/day	Sr^{89} μμc/day	Sr^{90} μμc/day	Total Ra μμc/day
—	4.7	6.3	—	1.3	6.7	—	3.0	2.3	—	6.8	<2.0
—	21.6	9.1	—	1.6	3.9	—	2.3	2.3	—	3.0	<0.9
—	10.6	10.6	—	8.6	5.9	—	—	—	—	7.7	<1.9
22.9	5.6	<5.7	—	—	—	—	—	—	—	—	—
15.0	5.7	<5.7	42.9	5.0	6.9	<9.3	7.4	<1.9	42.1	6.6	2.9
—	7.7	4.6	—	2.0	24.3	—	5.3	3.7	—	13.0	<1.9
24.3	5.6	<7.1	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	<9.3	10.0	9.7	<8.6	9.1	<1.7
—	—	—	—	—	—	248.5	17.8	<1.9	122.8	19.6	2.4
80.0	18.3	<10.0	—	—	—	<8.6	10.0	6.9	<10.7	13.7	2.7
—	13.4	3.6	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	4.0	2.6	—	—	—
—	—	—	—	—	—	—	4.4	2.6	—	7.1	<1.7
—	—	—	—	—	—	—	4.1	1.7	—	5.4	<1.2
<7.1	9.1	<5.7	<6.4	6.0	<1.3	5.7	4.7	<1.1	—	—	—
142.8	15.1	<10.0	164.2	10.1	9.6	103.5	14.3	<2.1	80.0	9.9	<2.3
92.1	9.0	<11.4	92.8	5.0	17.1	44.3	12.1	<2.4	21.4	5.7	<1.3
—	11.4	13.1	—	2.3	7.1	—	4.9	1.9	—	5.1	<1.8
—	—	—	—	—	—	38.6	12.1	5.7	78.5	12.7	<1.9
—	14.3	12.4	—	0.7	13.6	—	9.6	4.1	—	12.7	4.4
54.8	10.9	<8.2	76.6	4.3	9.6	58.5	7.9	3.3	52.0	9.2	<2.1

TABLE 4.—I^{131}, Cs^{137} AND Ba^{140}

[Based on 7-day

Station location	January 1961			February 1961			March 1961		
	I^{131} $\mu\mu c$/day	Cs^{137} $\mu\mu c$/day	Ba^{140} $\mu\mu c$/day	I^{131} $\mu\mu c$/day	Cs^{137} $\mu\mu c$/day	Ba^{140} $\mu\mu c$/day	I^{131} $\mu\mu c$/day	Cs^{137} $\mu\mu c$/day	Ba^{140} $\mu\mu c$/day
Alaska Palmer	[a]—	—	—	—	—	—	—	—	—
California Los Angeles	—	—	—	ND	<7.7	ND	ND	<12.9	ND
Colorado Denver	[b] ND	<5.1	ND	ND	<9.1	ND	ND	16.7	ND
Florida Tampa	—	—	—	—	—	—	—	—	—
Georgia Atlanta	—	—	—	—	—	—	ND	<10.0	—
Hawaii Honolulu	—	—	—	—	—	—	—	—	—
Illinois Chicago	—	—	—	—	—	—	—	—	—
Ohio Cleveland	—	—	—	—	—	—	—	—	—
Louisiana New Orleans	—	—	—	—	—	—	—	—	—
Massachusetts Boston	—	—	—	—	—	—	—	—	—
Missouri St. Louis	ND	<8.9	ND	ND	13.7	ND	ND	<9.4	ND
Montana Helena	—	—	—	—	—	—	—	—	—
Nebraska Omaha	—	—	—	—	—	—	—	—	—
New Mexico Albuquerque	—	—	—	—	—	—	—	—	—
New York New York	ND	70.0	ND	ND	<2.1	ND	ND	<5.7	ND
Tennessee Memphis	—	—	—	—	—	—	—	—	—
Texas Austin	—	—	—	ND	<12.1	ND	ND	<12.1	ND
Utah Salt Lake City	—	—	—	—	—	—	—	—	—
Virginia Norfolk	—	—	—	—	—	—	—	—	—
Washington Seattle	—	—	—	ND	8.9	ND	ND	31.4	ND
Averages	ND	28.0	ND	ND	<8.9	ND	ND	<14.0	ND

[a] Dash indicates no sample collected.
[b] ND indicates concentration is below the minimum level of detection. For averaging "ND" is assumed to be equal to zero.
[c] Data discarded because of sampling errors or sample leakage in shipment.

CONTENT OF INSTITUTIONAL DIET SAMPLES

composite samples]

April 1961			May 1961			June 1961			July 1961		
I^{131} μμc/day	Cs^{137} μμc/day	Ba^{140} μμc/day	I^{131} μμc/day	Cs^{137} μμc/day	Ba^{140} μμc/day	I^{131} μμc/day	Cs^{137} μμc/day	Ba^{140} μμc/day	I^{131} μμc/day	Cs^{137} μμc/day	Ba^{140} μμc/day
—	—	—	—	—	—	—	—	—	—	—	—
ND	6.6	ND	ND	6.6	ND	ND	<8.5	ND	ND	15.4	ND
ND	16.9	ND	ND	104.0	ND	ND	15.3	ND	ND	26.7	ND
—	—	—	—	—	—	—	—	—	—	—	—
ND	25.0	ND	ND	<9.3	ND	ND	25.7	ND	ND	12.9	ND
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	ND	25.7	ND	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
ND	9.1	ND	ND	37.4	ND	ND	35.4	ND	ND	26.4	ND
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
c	c	c	ND	20.0	ND	ND	12.9	ND	c	c	c
—	—	—	—	—	—	—	—	—	—	—	—
ND	<21.4	ND	ND	<10.7	ND	ND	22.1	ND	ND	<12.1	ND
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
ND	<12.0	ND	ND	47.4	ND	ND	43.7	ND	ND	39.4	ND
ND	<15.2	ND	ND	32.6	ND	ND	23.4	ND	ND	22.1	ND

TABLE 4.—I^{131}, Cs^{137} AND Ba^{140}

[Based on 7-day

Station location	August 1961			September 1961			October 1961		
	I^{13} μμc/day	Cs^{137} μμc/day	Ba^{140} μμc/day	I^{131} μμc/day	Cs^{137} μμc/day	Ba^{140} μμc/day	I^{131} μ c/day	Cs^{137} μμc/day	Ba^{140} μμc/day
Alaska Palmer	[a] —	—	—	—	—	—	<16.3	41.1	<16.3
California Los Angeles	[b] ND	20.1	ND	<19.6	19.6	<19.6	<13.6	<6.7	<13.6
Colorado Denver	ND	53.4	ND	<24.8	<12.4	<24.8	<19.4	9.7	<19.4
Florida Tampa	—	—	—	—	—	—	<22.8	90.0	<22.8
Georgia Atlanta	ND	<8.6	ND	<11.4	<5.7	<11.4	228.5	15.0	<15.7
Hawaii Honolulu	—	—	—	—	—	—	—	—	—
Illinois Chicago	—	—	—	[c]	[c]	[c]	88.5	<8.6	<17.1
Ohio Cleveland	—	—	—	—	—	—	—	—	—
Louisiana New Orleans	—	—	—	—	—	—	—	—	—
Massachusetts Boston	—	—	—	—	—	—	98.5	28.6	<20.0
Missouri St. Louis	—	—	—	[c]	[c]	[c]	27.1	27 1	<27.1
Montana Helena	—	—	—	—	—	—	—	—	—
Nebraska Omaha	—	—	—	—	—	—	—	—	—
New Mexico Albuquerque	—	—	—	—	—	—	—	—	—
New York New York	ND	12.9	ND	<12.5	17.1	<12.5	<12.9	<6.4	<12.9
Tennessee Memphis	—	—		—	—		98.5	25.0	<18.6
Texas Austin	ND	<12.9	ND	<27.3	<13.6	<27.3	27.1	<13.6	<27.1
Utah Salt Lake City	—	—	—	—	—	—	—	—	—
Virginia Norfolk	—	—	—	—	—	—	—	—	—
Washington Seattle	ND	34.6	ND	<22.6	45.1	<22.6	25.6	38.3	<25.6
Average	ND	23.8	ND	<19.7	<18.8	<19.7	56.6	25.8	<19.7

[a] Dash indicates no sample collected.
[b] ND indicates concentration is below the minimum level of detection. For averaging "ND" is assumed to be equal to zero.
[c] Data discarded because of sampling errors or sample leakage in shipment.

CONTENT OF INSTITUTIONAL DIET SAMPLES—Continued

composite samples]

November 1961			December 1961			January 1962			February 1962		
I^{131} μμc/day	Cs^{137} μμc/day	Ba^{140} μμc/day	I^{131} μμc/day	Cs^{137} μμc/day	Ba^{140} μμc/day	I^{131} μμc/day	Cs^{137} μμc/day	Ba^{140} μμc/day	I^{131} μμc/day	Cs^{137} μμc/day	Ba^{140} μμc/day
<22.3	67.3	44.9	<18.7	28.6	18.6	17.1	11.4	11.4	<20.1	30.1	<20.1
15.6	7.9	<15.6	<13.6	<6.8	<13.6	<18.5	27.8	47.1	<12.7	6.3	<12.7
<17.0	8.6	<17.0	67.1	22.9	22.9	—	—	—	<17.8	17.8	<17.8
21.4	178.5	<14.3	—	—	—	—	—	—	—	—	—
<13.6	<7.1	<12.9	<17.1	<8.6	<17.1	<18.6	9.3	<18.6	<14.3	22.1	<14.3
40.3	30.3	20.1	44.3	32.8	22.8	<22.0	32.8	44.3	<22.4	11.1	<22.4
25.7	<8.6	<15.7	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	<18.6	<9.3	<18.6	<17.1	<8.6	<17.1
—	—	—	—	—	—	<18.6	12.9	<18.6	<21.4	30.7	<21.4
71.4	<12.1	<22.8	—	—	—	<17.1	41.4	<17.1	<21.4	<10.7	<21.4
<27.3	27.3	<27.3	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	<19.8	20.0	40.0	—	—	—
—	—	—	—	—	—	<23.1	<11.6	34.3	<17.0	17.1	17.1
—	—	—	—	—	—	<14.0	<7.0	<14.0	<12.4	<6.2	<12.4
<14.3	<7.9	<14.3	<12.9	<6.4	<12.9	<11.4	<5.7	<11.4	—	—	—
42.8	<10.7	<22.1	<18.6	<10.0	<18.6	<21.4	<10.7	<21.4	<21.4	<10.7	<21.4
81.4	<13.6	<27.2	<21.4	<10.7	<21.4	<24.3	32.1	<24.3	<12.9	<6.4	<12.9
<49.7	12.4	<24.8	<17.7	17.7	<17.7	<16.7	<8.4	<16.7	<17.6	17.1	17.6
—	—	—	—	—	—	<20.0	<10.0	<20.0	<18.6	<9.3	<18.6
167.1	35.7	47.7	22.8	34.3	22.8	<31.7	31.4	31.4	<31.7	31.4	<31.7
50.8	30.6	<23.3	<25.4	<17.9	18.8	<19.6	<17.6	<24.3	<19.4	<15.7	<18.6

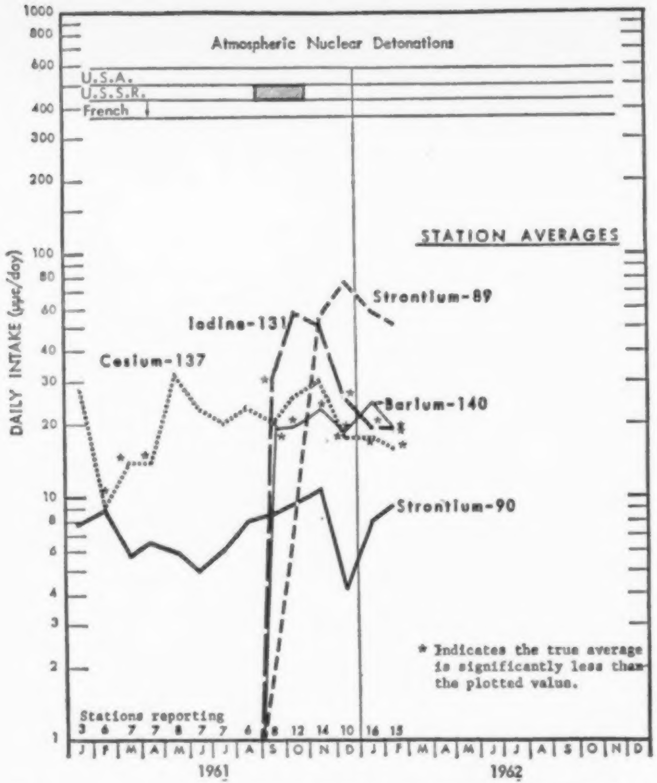

FIGURE 2.—RADIONUCLIDES IN INSTITUTIONAL DIET SAMPLES—STATION AVERAGES

to be significantly less than the calculated average. In such cases a "less than" sign precedes the average to denote this.

Radiation Protection Guide Comparisons

During the 14-month period reported, the dietary intake of strontium–90 ranged between 0.7 and 17.4 μμc/day with an average value of 7.5 μμc/day. The average lies within the lowest Radiation Protection Guide (RPG) limit of the Federal Radiation Council of 0 to 20 μμc/day for strontium–90 and the maximum at the bottom of Range II (20–200) (*1, 2*).

The dietary intake of total radium ranged between <1.1 and 29.7 μμc/day with an average of <6.1 μμc/day. Assuming the radium–226 component of the total radium activity is at least 30 percent, the intake of radium–226 via the diet probably exceeds the Range I level of the RPG (0 to 2 μμc/day for radium–226).

Following the resumption of nuclear weapons testing in the atmosphere in 1961, iodine–131 dietary intake increased from non-detectable to a station high of 228.5 μμc/day with an average during the reported 14 months of <14.5 μμc/day. This average was in Range II of the iodine–131 RPG (10–100 μμc/day) while the one month high at one station was in Range III (100–1000 μμc/day). The May 1962 *RHD* contains a discussion of environmental radiation protection standards which should be referred to for an understanding of the RPG (*2*).

The variation in strontium–90 and total radium contents could not be attributed to the presence of any specific diet item, even though attempts were made to document the diet items by menu as served at the sampling point. Comparison of the total diet intake levels of strontium–90 with those previously reported for milk confirms previous estimates that the milk may account for approximately one-half of the dietary intake of the radionuclide.

REFERENCES

(*1*) Federal Radiation Council, "Background Material for the Development of Radiation Protection Standards, Report No. 2," Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. (September 1961).

(*2*) Chadwick, Donald R. and Conrad P. Straub, "Considerations in Establishing Radiation Protection Standards for Radioactivity in the Environment," *Radiological Health Data*, III: 159 (May 1962).

Strontium–90 Content of the Diet of Children and Juveniles in the Federal Republic of Germany During 1959 [1]

D. Merten and E. Knoop, Physikalisches Institut der Bundesforschungsanstalt für Milchwirtschaft, Kiel, Germany

The following tables present the results of assays conducted in the Federal Republic of Germany for strontium–90 in the diet of children and juveniles during 1959.

Data appearing in tables 1 and 2 were abstracted from the report, "The Strontium–90 Content of the Diet of Children and Juveniles in 1959," by D. Merten and E. Knoop, Physikalisches Institut der Bundesforschungsanstalt für Milchwirtschaft, Kiel, Germany, for the United Nations Scientific Committee on the Effects of Atomic Radiation. This abstract was prepared by Dr. Merten.

Estimates were made of the average daily intake of strontium–90 by children through the chief categories of food, i.e., bread, potatoes, vegetables, fruits, and milk. The figures given were divided into age groups from 0 to 20 years. Data on the specific activity of the individual products were obtained from various investigations and were completed by taking data from the literature. The figures for food consumption used for estimating the daily intake of strontium–90 by children and juveniles through their diet were taken partly from publications and partly from the results of an inquiry into the dietary habits of 2,000 children.

Generally speaking, it has been found that the amount of strontium–90 offered in food increased at a rate corresponding to the increase in consumption due to age. On the average, the total amount of strontium–90 increased from 8 μμc/day in the age group of 1–3 years to 13 μμc/day in the group 15–20 years, i.e., by some 60 percent. Departures from these figures may be explained by differences in the qualitative and quantitative compositions of the diet due to different environments. The amount of strontium–90 offered is strikingly low in the case of breast fed infants.

A slight increase in the average contamination of diet (Sr^{90}/gm Ca) with age is also found. The reason for it is to be found in the change in the quantitative composition of the diet with increasing age. The consumption of products which are relatively low in calcium, such as cereals and potatoes, increases while the consumption of calcium-rich products, especially milk, remains the same.

The mean contamination of food in the age groups examined was 13.6 μμc Sr^{90}/gmCa. This value is in good agreement with the results obtained from a direct determination of the mean contamination of the "normal" diet of adults. In this case the value obtained was 11.5 μμc Sr^{90}/gm Ca. This result shows that there is no significant difference between the contamination of the diet of children and juveniles and that of the diet of adults.

TABLE 1.—MEAN CONTAMINATION OF THE DIET OF CHILDREN AND JUVENILES IN GERMANY

[Concentrations in μμc Sr^{90}/gm Ca]

Age group (years)	Mother's milk feeding	Artificial feeding	Kraut's recommended diet [1]		Diet in a children's home		Diet of elementary and secondary school children		Diet in a boarding school		"Normal" diet of adults
0–1	7.0	10.9									
1–3			10.8								
4–6			11.4		9.6						
7–10			11.7		13.6		13.3				
			Female	Male	Female	Male	Female	Male	Female	Male	
11–14			12.2	12.8	14.2	14.7	14.4	14.0	12.5	12.1	
15–20			12.7	13.2	17.3	14.5	15.5	13.5	13.4	13.0	
>20											12

[1] "Recommended dietary allowances, by individual articles of food," Prof. Kraut.

[1] Abstract prepared by Dr. Merten.

Table 2.—DAILY STRONTIUM-90 INTAKE BY CHILDREN AND JUVENILES IN GERMANY

[Concentrations in $\mu\mu c$/day]

Age group (years)	Mother's milk feeding	Artificial feeding	Kraut's recommended diet		Diet in a children's home		Diet of elementary and secondary school children		Diet in a boarding school		"Normal" diet of adults
0–1	4.2	8.0									
1–3			8.2								
4–6			9.4		5.9						
7–10			10.0		10.9		11.2				
			Female	Male	Female	Male	Female	Male	Female	Male	
11–14			10.8	11.2	8.2	11.9	11.3	14.3	8.7	13.3	
15–20			12.0	12.9	10.8	16.9	10.2	15.6	8.3	12.5	
>20											11.5

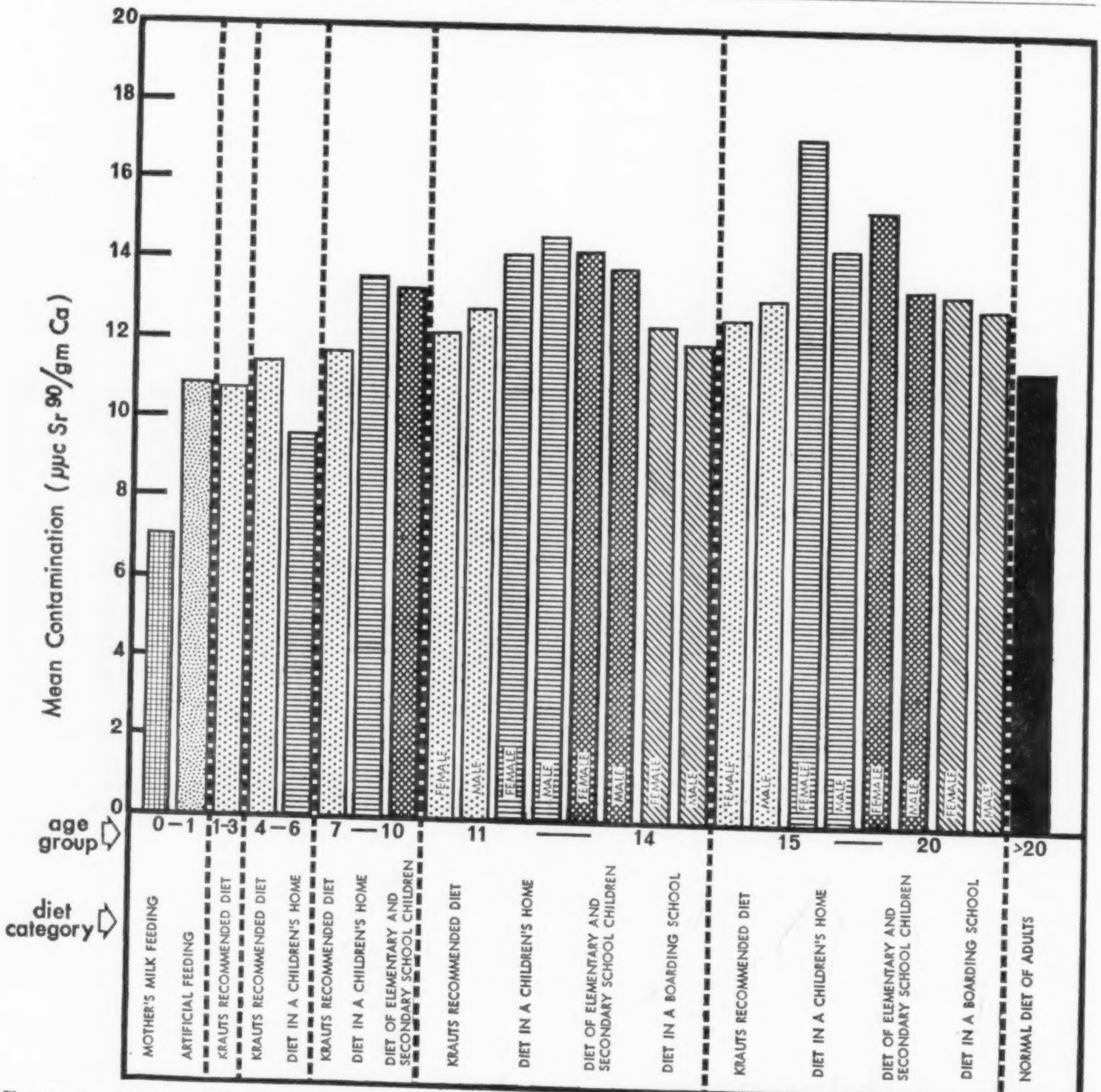

Figure 1.—STRONTIUM-90 CONTENT OF THE DIET OF CHILDREN AND JUVENILES IN THE FEDERAL REPUBLIC OF GERMANY DURING 1959

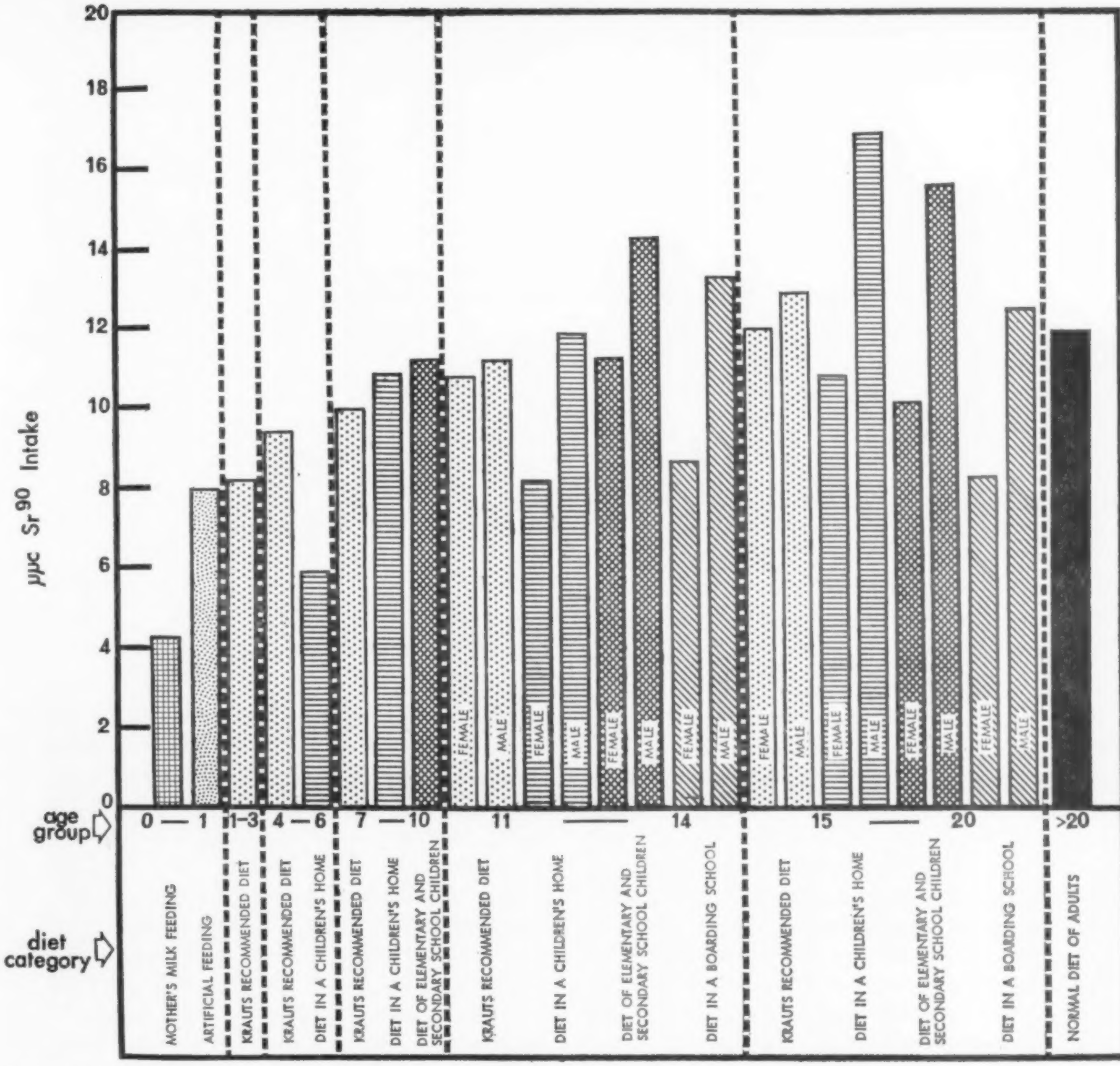

FIGURE 2.—STRONTIUM-90 OFFERED DAILY TO CHILDREN AND JUVENILES IN THE FEDERAL REPUBLIC OF GERMANY DURING 1959

SECTION III.—MILK

Radionuclides in Pasteurized Milk

February 1962

Division of Radiological Health
Division of Environmental Engineering and Food Protection
Public Health Service

Milk monitoring has been conducted by the Public Health Service since early 1957, when the first program was established to develop suitable sampling methods and radiochemical analytical procedures. Raw milk was initially selected for investigation. During this program, it became evident that a broader sampling program was necessary—one more directly related to the milk consumed by the population. The result was the initiation, in the first quarter of 1960, of a pasteurized milk sampling program designed to provide data representative of the milk consumed in selected municipalities. Both programs were reported concurrently until June 1961 to permit comparison of the differences between the earlier, limited, milkshed sampling results and those of the new program.

Raw milk sampling results reported for June 1961 in the November 1961 *Radiological Health Data (RHD)* were the last regular publication of such data. A summary discussion of the raw milk sampling program in the December 1961 *RHD* presented the gross relationship between fallout and the occurrence of fission products in milk as determined from this study.

During February 1962 the surveillance of pasteurized milk was conducted at 61 stations (shown in figure 1) with the cooperation of State and local milk sanitation agencies who ship samples to the PHS Southeastern and Southwestern Radiological Health Laboratories for analysis. The former analyzes samples from the 30 states generally east of the Mississippi River, and the latter analyzes samples from the western states. Publication in *RHD* follows about four months after sample collection because of time required for shipment, processing, decay-product buildup, data compilation, and publication procedures.

The current program emphasizes (1) measurement of the levels of radioactivity of samples of pasteurized milk consumed by the public in various regions of the country, and (2) provision of at least one sampling point within virtually all states and additional points when indicated by widely varying conditions of the milk supply or the need to cover large population groups. Each sample is composited in proportion to the volume of milk sold by those plants supplying not less than 90 percent of a city's milk supply. Prior to September 15, 1961, this composite sample was taken from one day's sales per month and was as representative

FIGURE 1.—PASTEURIZED MILK AREA SAMPLING STATIONS, FEBRUARY 1962

of a community's total supply as could be achieved under practical conditions. Since September 15, the sampling schedule has been accelerated.

During February 1962, sampling on a weekly basis was performed at most stations. All surveillance data is subject to continuing review and evaluation to observe unusual patterns or concentrations which may require immediate attention and adjustment in the pasteurized milk sampling program operation. Further atmospheric nuclear testing may require an immediate re-evaluation and readjustment of the sampling frequency and analytical schedule for this program.

Iodine–131, cesium–137, and barium–140 are determined by gamma scintillation spectroscopy, while strontium–89 and strontium–90 are determined following radiochemical separation. The minimum levels of detection for strontium–89, strontium–90, iodine–131, cesium–137, and barium–140 in terms of μμc/liter are 5, 1, 10, 5, and 10, respectively.

In the last two issues, *RHD* published graphical average monthly concentrations of strontium–90 in pasteurized milk from 12 selected cities of the monitoring network. This month, another eight cities are similarly treated in figures 2 and 3.

Figure 4 shows the February 1962 strontium–89 and strontium–90 concentrations plotted on an outline map of the United States.

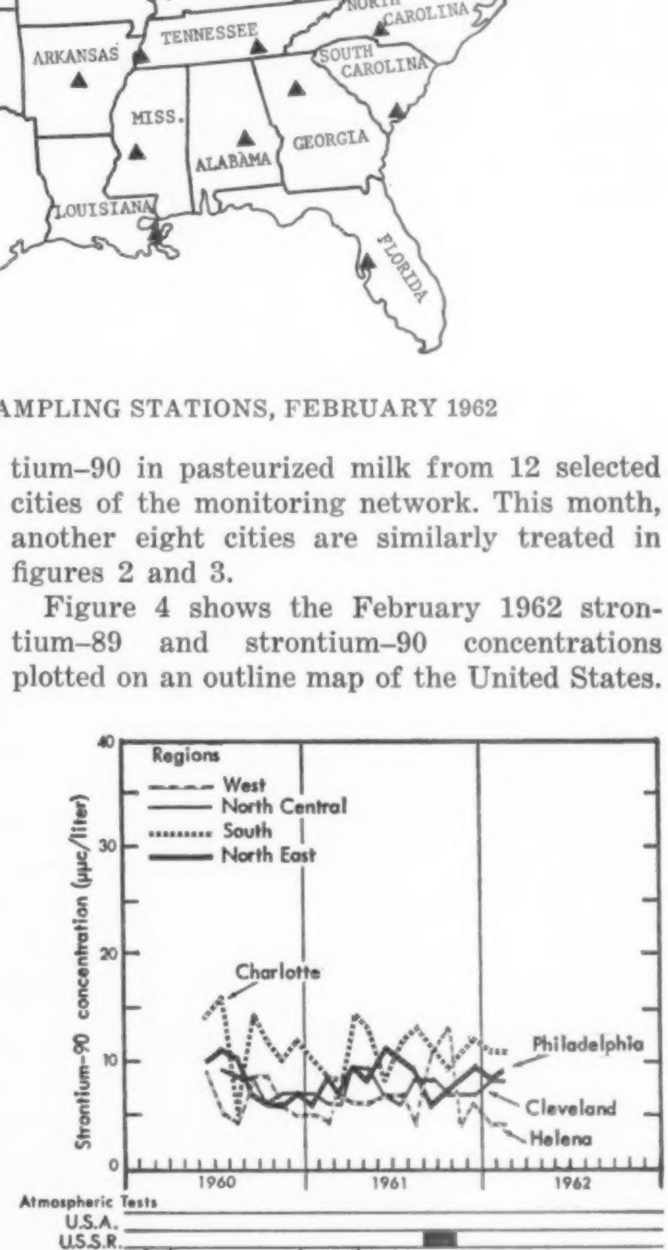

FIGURE 2.—STRONTIUM–90 CONCENTRATIONS IN PASTEURIZED MILK

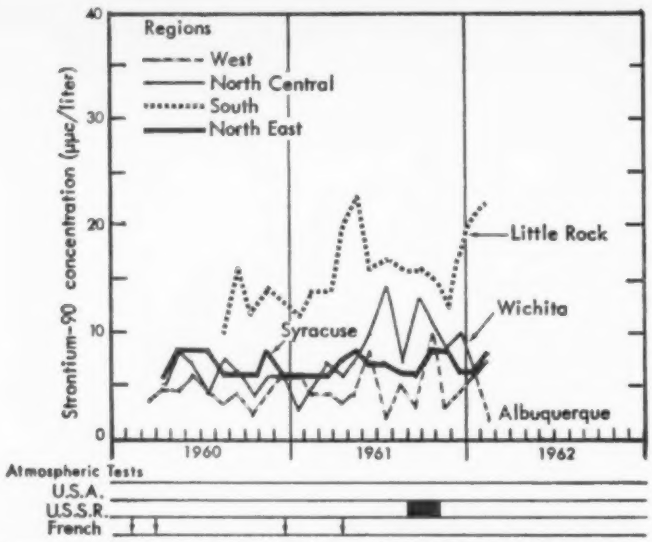

FIGURE 3.—STRONTIUM–90 CONCENTRATIONS IN PASTEURIZED MILK

Still evident, as during December and January, is the strontium–89 pattern of nearly non-detectable concentrations in the Northeastern and North Central States, low concentrations in the West, and higher concentrations in the South. This pattern, apparently, is due to the practice of feeding cattle during the winter on silage harvested prior to the resumption of atmospheric nuclear weapons testing while Southern dairy cattle were feeding on pasture contaminated by relatively fresh fission products containing strontium–89. While strontium–90 concentrations have increased at scattered locations in the South, the network average has remained nearly constant.

Table 1 presents a summary of all available analyses for February 1962. These data are an average of weekly samples in most instances. When radionuclides are not detectable, one-half the minimum levels of detection are used for averaging.

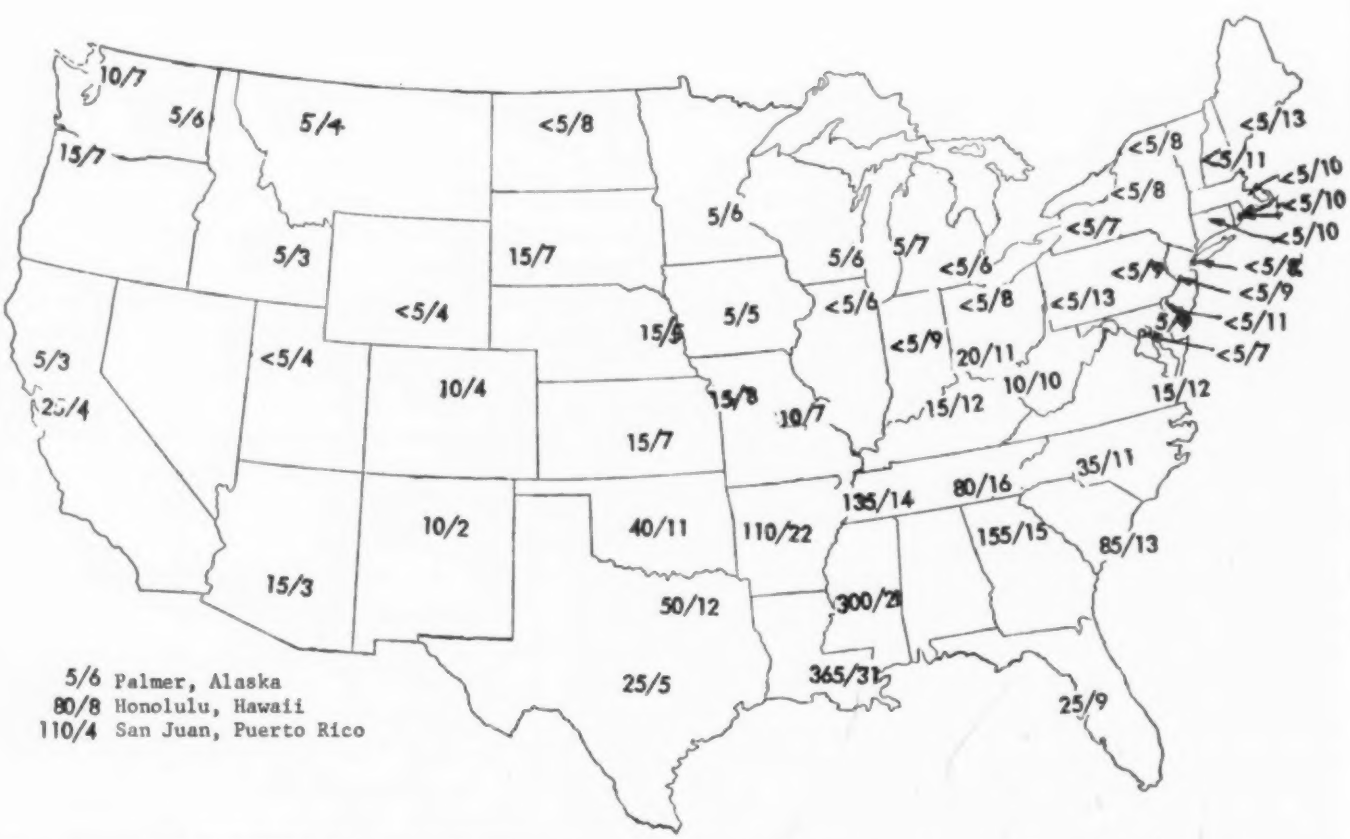

FIGURE 4.—STRONTIUM–89, STRONTIUM–90 CONCENTRATIONS (μμc/liter) IN PASTEURIZED MILK

TABLE 1.—RADIOACTIVITY IN PASTEURIZED MILK, FEBRUARY 1962

[Average radioactivity concentrations in $\mu\mu c$/liter]

Area		Calcium (gm/liter)		Strontium-89		Strontium-90		Iodine-131		Cesium-137		Barium-140	
City	State	Fourth quarter	Av. for month	Fourth quarter	Av. for month	Fourth quarter	Av. for month	Fourth quarter	Av. for month	Fourth quarter	Av. for month	Fourth quarter	Av. for month
Montgomery	Ala.	1.22	NS	10	NS	6	NS	20	<10	<5	20	20	NS
Palmer	Alaska	1.10	1.05	60	5	12	6	130	<10	15	10	40	10
Phoenix	Ariz.	1.05	1.06	10	15	6	3	50	<10	5	<5	<10	<10
Little Rock	Ark.	1.20	1.18	70	110	15	22	100	<10	20	20	30	10
Sacramento	Calif.	1.13	1.10	10	5	5	3	20	<10	10	<5	<10	<10
San Francisco	Calif.	1.09	1.14	10	25	3	4	20	<10	5	5	<10	<10
Denver	Colo.	1.10	1.10	20	10	6	4	50	10	10	5	10	10
Hartford	Conn.	1.17	1.11	25	<5	8	10	30	<10	10	10	30	<10
Wilmington	Del.	1.17	1.18	50	<5	11	11	40	<10	5	<5	30	<10
Washington	D. C.	1.17	1.18	35	<5	9	7	30	<10	5	<5	20	<10
Tampa	Fla.	1.22	1.24	20	25	6	9	30	<10	70	45	20	<10
Atlanta	Ga.	1.20	1.18	25	150	11	15	50	<10	[a] 5	35	20	20
Honolulu	Hawaii	1.07	1.04	10	80	6	8	20	<10	15	10	<10	<10
Idaho Falls	Idaho	1.05	1.10	25	5	6	3	80	20	10	10	10	10
Chicago	Ill.	1.18	1.16	50	<5	7	6	80	<10	[a] 10	<5	40	<10
Indianapolis	Ind.	1.21	1.20	40	<5	9	9	50	<10	<5	10	20	<10
Des Moines	Iowa	1.06	1.08	65	5	11	5	180	<10	10	10	20	<10
Wichita	Kans.	1.06	1.09	40	15	10	7	100	<10	10	<5	10	<10
Louisville	Ky.	1.19	1.16	45	15	11	12	60	<10	<5	<5	30	<10
New Orleans	La.	1.26	1.20	105	365	15	31	60	<10	15	65	40	40
Portland	Maine	1.19	1.17	60	<5	11	13	50	<10	20	<5	40	<10
Baltimore	Md.	1.17	1.17	35	5	8	9	40	<10	<5	5	20	<10
Boston	Mass.	1.18	1.18	70	<5	11	10	60	<10	10	<5	40	<10
Detroit	Mich.	1.17	1.14	40	<5	7	6	100	<10	5	<5	30	<10
Grand Rapids	Mich.	1.19	1.18	60	5	7	7	50	<10	<5	<5	30	<10
Minneapolis	Minn.	1.10	1.07	110	5	12	6	170	<10	15	10	40	10
Jackson	Miss.	1.28	1.26	95	300	14	21	70	<10	5	35	40	30
Rapid City	S. D.		1.12	80	15	16	7	60	<10	10	10	30	<10
Kansas City	Mo.	1.06	1.05	75	15	10	8	130	10	15	10	20	10
St. Louis	Mo.	1.08	1.07	35	10	9	7	90	<10	10	10	10	<10
Helena	Mont.	1.07	1.08	15	5	8	4	100	20	20	<5	10	10
Omaha	Nebr.	1.08	1.08	100	15	10	5	140	10	10	5	30	10
Manchester	N. H.	1.20	1.19	35	<5	12	11	50	<10	25	20	40	<10
Trenton	N. J.	1.19	1.17	35	<5	9	9	40	<10	<5	<5	20	<10
Albuquerque	N. Mex.	1.09	1.06	5	10	6	2	30	20	10	5	<10	20
Buffalo	N. Y.	1.12	1.12	35	<5	8	7	40	<10	5	<5	20	<10
New York	N. Y.	1.13	1.14	40	<5	8	8	50	<10	5	<5	30	<10
Syracuse	N. Y.	1.16	1.12	50	<5	7	8	60	<10	10	<5	40	<10
Charlotte	N. C.	1.27	1.18	25	35	11	11	20	<10	<5	<5	20	<10
Minot	N. D.	1.09	1.03	15	<5	11	8	60	<10	10	10	<10	<10
Cincinnati	Ohio	1.22	1.16	50	20	8	11	70	<10	<5	<5	30	<10
Cleveland	Ohio	1.18	1.15	35	<5	7	8	50	<10	5	<5	20	<10
Oklahoma City	Okla.	1.18	1.16	60	40	8	11	100	<10	10	<5	20	<10
Portland	Oreg.	1.05	1.07	70	15	17	7	80	<10	25	15	20	<10
Philadelphia	Pa.	1.20	1.20	30	<5	8	9	40	<10	<5	<5	20	<10
Pittsburgh	Pa.	1.16	1.18	40	<5	10	13	40	<10	5	<5	30	<10
San Juan	P. R.	1.18	1.12	55	110	6	4	20	<10	10	20	20	20
Providence	R. I.	1.18	1.15	55	<5	9	10	50	<10	10	<5	30	<10
Charleston	S. C.	1.22	1.22	15	85	11	13	30	<10	20	15	20	10
Chattanooga	Tenn.	1.27	1.24	50	80	12	16	50	<10	5	20	20	20
Memphis	Tenn.	1.24	1.23	60	135	11	14	90	<10	10	<5	20	20
Austin	Tex.	1.18	1.16	30	25	5	5	40	<10	[a]<5	<5	20	<10
Dallas	Tex.	1.23	1.20	45	50	9	12	50	<10	[a]<5	<5	20	<10
Salt Lake City	Utah	1.11	1.08	20	<5	5	4	60	10	10	5	10	<10
Burlington	Vt.	1.18	1.16	40	<5	9	8	50	<10	10	<5	30	<10
Norfolk	Va.	1.23	1.20	60	15	10	12	40	<10	5	<5	20	<10
Seattle	Wash.	1.11	1.09	60	10	13	7	80	<10	20	10	20	<10
Spokane	Wash.	[a]1.12	1.10	[a]10	5	[a] 6	6	60	<10	15	10	10	<10
Charleston	W. Va.	1.18	1.14	55	10	10	10	30	<10	<5	<5	20	<10
Milwaukee	Wis.	1.17	1.20	35	<5	7	6	80	<10	15	<5	30	<10
Laramie	Wyo.	1.09	1.05	<5	<5	6	4	30	10	15	10	10	<10
Network average		1.16	1.12	43	31	9	8.7	61	<10	11	9	22	<10

[a] Average based on two months.
[b] NS indicates no analysis made.

SECTION IV.—WATER

National Water Quality Network

January 1962

Division of Water Supply and Pollution Control, Public Health Service

The National Water Quality Network operated in cooperation with State and local agencies and industrial organizations, commenced operations in October 1957. By the end of January 1962, 105 sampling stations were submitting water samples for analyses. These stations are located on major waterways used for public water supply, propogation of fish and wildlife, recreational purposes, and for agricultural, industrial, and other uses. Some of these stations are on interstate, coastal, and international boundary waters, and waters on which activities of the Federal Government may have an impact. Ultimately, a total of approximately 300 stations will be in operation. Radioactivity is not yet being reported for a few of the more recently established stations.

Samples of water are examined for chemical, physical, and biological quality insofar as these relate to pollution. Samples for some determinations are taken weekly, others monthly, and for some, continuous composite samples of 10 to 15 days are obtained.

Gross alpha and beta measurements are made on both suspended and dissolved solids (strontium-90 on the total solids only) in raw surface water samples. The levels of radioactivity associated with dissolved solids provide a rough measure of the levels which may be found in treated water, where such water treatment removes substantially all of the suspended matter. Naturally-occurring radioactive substances in the environment are the source of essentially all of the alpha activity. The contamination of the environment from man-made sources is the major contributor to the beta activity. It should be noted that with the cessation of weapons testing for a period of three years, the beta activity in most raw surface waters generally had approached a level attributable solely to natural sources. Natural beta activity can be two or three times the natural alpha activity based on the presence of the same nuclides. Since the resumption of nuclear weapons testing in the atmosphere, increased radioactivity of surface waters has been observed.

For the first two years of the Network operations, beta determinations were made on weekly samples. Alpha determinations were reported generally on composites of more than one weekly sample. Since January 1959, a portion of each sample from all stations in the Network has been composited into a three-month sample for measurement of strontium-90 concentration.

Beginning January 1, 1960, the frequency of beta determinations varied depending on the

FIGURE 1.—NATIONAL WATER QUALITY NETWORK SAMPLING STATIONS, JANUARY 1962

status of each particular station. For the first operating year of each new station, analyses were being conducted weekly. Weekly analyses were to be continued indefinitely for all stations which may be affected by waste discharges from nuclear installations. Semimonthly determinations (on composites of 2 or 3 weekly samples) were conducted for stations which still showed some beta activity above background. Monthly determinations (on composites of all samples received from a station during the month) were conducted on samples from streams where beta activity was at background levels.

Beginning January 1, 1960, the frequency of alpha determinations also was changed. For the first operating year of each new station, analyses were to be done weekly. At some stations on the Colorado and Animas Rivers determinations were done on weekly samples or semimonthly on two-or three-week composites. The remainder of the stations were scheduled so that each made one gross alpha determination per month.

Following the resumption of nuclear weapons testing in the atmosphere by the U.S.S.R., the gross beta and alpha determination schedules were altered. Since September 1, 1961, gross beta determinations have been made on all samples collected. Since October 1, 1961, gross alpha determinations have been made on one sample from each station each month, unless there is evidence of alpha activity in excess of background levels. In the latter instance, an alpha determination has been made on a weekly or bi-weekly basis, depending on what is considered the norm for a particular station.

All data reported in table 1 represent the average of all data reported for the periods indicated. The reported strontium-90 data are the results of determinations on three-month composite samples for the quarter ending in the month shown.

Additional information and data may be obtained from the following sources:

National Water Quality Network Annual Compilation of Data, PHS Publication No. 663, Water Years 1957–58, 1958–59, 1959–60. Public Health Service, Division of Water Supply and Pollution Control, Washington 25, D. C.

TABLE 1.—RADIOACTIVITY IN RAW SURFACE WATERS

(Average concentrations in $\mu\mu c$/liter)

Station	Quarter ending Sept. 30, 1961	January 1962					
	Strontium-90	Beta activity			Alpha activity		
	Total	Suspended	Dissolved	Total	Suspended	Dissolved	Total
Allegheny River: Pittsburgh, Pa	0.3	—	—	—	—	—	—
Animas River: Cedar Hill, N. Mex	0.3	17	34	51	1	13	14
Apalachicola River: Chattahoochie, Fla	0.4	—	—	—	—	—	—
Arkansas river:							
Coolidge, Kansas	2.3	50	114	164	4	63	67
Ponca City, Okla	—	83	42	125	0	5	5
Pendleton Ferry, Ark	—	70	39	109	2	0	2
Big Horn River: Hardin, Mont	—	25	39	64	<1	8	8
Big Sioux River: Sioux Falls, S. Dak	0.4	73	43	116	2	3	5
Chattahoochie River:							
Atlanta, Ga	—	10	7	17	0	0	0
Columbus, Ga	—	37	16	53	0	0	0
Clear Water River: East Lewiston, Idaho	—	33	41	74	0	0	0
Colorado River:							
Loma, Colo	—	15	27	42	3	5	8
Page, Ariz	—	50	40	90	12	13	25
Boulder City, Nev	1.0	8	23	31	<1	7	7
Parker Dam, Calif	—	6	24	30	1	7	8
Yuma, Ariz	—	28	67	95	2	10	12
Columbia River:							
Wenatchee, Wash	—	6	8	14	0	0	0
Pasco, Wash	1.1	70	663	733	0	1	1
Bonneville Dam, Oreg	*0.6	58	332	390	0	<1	<1
Clatskanie, Oreg	—	25	110	135	—	—	—
McNary Dam, Oreg	1.2	41	290	331	0	1	1
Connecticut River:							
Northfield, Mass	0.4	11	25	36	0	0	0
Wilder, Vt	—	10	28	38	<1	0	<1
Cumberland River: Clarksville, Tenn	0.4	47	25	72	4	0	4
Delaware River:							
Martins Ck, Pa	—	31	37	68	0	0	0
Trenton, N. J	—	44	24	68	<1	0	<1
Escambia River: Century Fla	*0.9	34	17	51	0	0	0
Great Lakes							
Buffalo, N. Y	—	20	9	29	1	1	2
Detroit, Mich	*0.6	7	10	17	0	0	0
Port Huron, Mich	0.4	9	9	18	—	—	—
Milwaukee, Wis	—	6	7	13	0	0	0
Sault Ste. Marie, Mich	—	4	6	10	1	0	1
Gary, Ind	0.2	12	14	26	0	0	0
Duluth, Minn	—	6	7	13	0	0	0
Hudson River: Poughkeepsie, N. Y	0.2	17	30	47	0	0	0
Illinois River:							
Peoria, Ill	0.4	23	45	68	0	9	9
Grafton, Ill	—	35	43	78	4	1	5
Kanawha River: Winfield Dam, W. Va	—	10	10	20	0	0	0
Klamath River: Copco, Oreg	—	17	21	38	1	1	2
Little Miami River: Cincinnati, Ohio	1.1	84	54	138	2	0	2
Merrimack River: Lowell, Mass	*0.7	—	—	—	—	—	—
Mississippi River:							
St. Paul, Minn	0.9	8	18	26	1	0	1
Dubuque, Iowa	—	2	15	17	0	0	0
Burlington, Iowa	0.6	2	15	17	0	2	2
E. St. Louis, Ill	—	22	34	56	0	2	2
Cape Girardeau, Mo	0.8	68	26	94	0	2	2
West Memphis, Ark	—	53	33	86	2	<1	2
Delta, La	*0.4	91	35	126	4	1	5
New Orleans, La	—	29	27	56	4	1	5
Vicksburg, Miss	—	118	46	164	3	0	3
Missouri River:							
Williston, N. Dak	—	5	14	19	1	2	3
Bismarck, N. Dak	—	3	10	13	0	4	4
Yankton, S. Dak	0.6	10	26	36	1	4	5
Omaha, Nebr	—	8	24	32	0	5	5
St. Joseph, Mo	—	18	33	51	0	7	7
Kansas City, Kan	—	58	42	100	—	—	—
Missouri City, Mo	—	89	38	127	11	6	17
St. Louis, Mo	1.4	47	31	78	1	2	3
Monongahela River: Pittsburgh, Pa	0.4	6	23	29	0	0	0
North Platte River: Henry, Nebr	—	13	49	62	<1	35	35
Ohio River:							
East Liverpool, Ohio	0.4	—	—	—	—	—	—
Cincinnati, Ohio	—	26	18	44	1	0	1
Louisville, Ky	0.4	37	21	58	1	<1	1
Evansville, Ind	—	43	18	61	2	1	3
Cairo, Ill	1.1	80	25	105	5	1	
Ouchita River: Bastrop, La	—	68	75	143	1	<1	1
Platte River: Plattsmouth, Nebr	—	78	32	110	8	8	16
Potomac River:							
Williamsport, Md	—	20	14	34	1	0	1
Great Falls, Md	—	14	23	37	1	0	1
Rainy River:							
Baudette, Minn	—	5	7	12	0	0	0
International Fls, Minn	—	1	10	11	0	0	0
Red River, South:							
Index, Ark	—	128	48	176	0	1	1
Alexandria, La	1.0	49	39	88	1	1	2
Denison, Tex	—	8	22	30	1	0	1
Rio Grande River:							
Alamosa, Colo	*0.4	3	8	11	0	1	1

Table 1.—RADIOACTIVITY IN RAW SURFACE WATERS

(Average concentrations in $\mu\mu c$/liter)

Station	Quarter ending Sept. 30, 1961	January 1962					
	Strontium-90	Beta activity			Alpha activity		
	Total	Suspended	Dissolved	Total	Suspended	Dissolved	Total
El Paso, Tex	—	32	42	74	4	8	12
Laredo, Tex	—	6	18	24	1	2	3
Brownsville, Tex	—	14	26	40	1	5	6
Roanoke River: John H. Kerr Resr. & Dam, Va	—	37	21	58	<1	0	<1
Sabine River: Ruliff, Tex	—	47	59	106	0	0	0
San Juan River: Shiprock, N. Mex	—	20	37	57	<1	12	12
St. Lawrence River: Massena, N. Y	—	10	12	22	—	—	—
Schuylkill River: Philadelphia, Pa	—	11	23	34	—	—	—
Savannah River:							
North Augusta, S. C	—	38	38	76	0	0	0
Port Wentworth, Ga	0.4	20	25	45	1	0	1
Shenandoah River: Berryville, Va	—	26	15	41	1	0	1
Snake River:							
Wawawai, Wash	0.3	14	18	32	0	3	3
Payette, Idaho	—	13	20	33	0	4	4
South Platte River: Julesburg, Colo	0.7	—	—	—	—	—	—
Susquehanna River:							
Sayre, Pa	0.3	18	26	44	0	0	0
Conowingo, Md	0.3	23	28	51	0	0	0
Tennessee River:							
Lenoir City, Tenn	—	65	26	91	2	1	3
Chattanooga, Tenn	0.6	34	49	83	1	0	1
Bridgeport, Ala	0.7	18	32	50	0	0	0
Pickwick Landing, Tenn	—	33	53	86	<1	0	<1
Tombigbee River: Columbus, Miss	—	111	43	154	2	0	2
Truckee River: Farad, Calif	—	9	10	19	<1	<1	1
Wabash River: New Harmony, Ind	—	224	57	281	5	3	8
Yakima River: Richland, Wash	0.4	9	10	19	<1	<1	1
Yellowstone River: Sidney, Mont	—	8	24	32	1	6	7

[a] April–September strontium 90 data.

"Report on National Water Quality Control Network," submitted by Dr. F. J. Weber, Chief, Division of Radiological Health, PHS, at the Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, 1: 167–169 (May 1959).

Setter, L. R., J .E. Regnier, and A. Diephaus, "Radioactivity of Surface Waters in the United States," *Journal of the American Water Works Association*, 51: 1377 (Nov. 1959).

Straub, C. P., L. R. Setter, A. Goldin, and P. F. Hallbach, "Strontium-90 in Surface Waters," *Journal of the American Water Works Association*, 52: 756 (June 1960).

Setter, L. R., and S. L. Baker, "Radioactivity of Surface Waters in the United States," *Radiological Health Data*, 1: 18–31 (Oct. 1960).

Straub, C. P., "Significance of Radioactivity Data," *Journal of the American Water Works Association*, 53: 704 (June 1961).

SECTION V.—OTHER DATA

External Gamma Activity

April 1962

Division of Radiological Health, Public Health Service

Daily measurements of external gamma radiation are made at stations of the Radiation Surveillance Network to assure detection of any substantial deviations from normal background levels. Portable geiger-mueller survey instruments are used to obtain measurements at three feet above the ground surface. April 1962 data reported in table 1 are characteristic of individual station observations which in recent years have defined the range of normal background values.

TABLE 1.—EXTERNAL GAMMA ACTIVITY, APRIL 1962

Station location		Average (mr/hr)	Station location		Average (mr/hr)
City	State		City	State	
Adak	Alaska	0.01	Minneapolis	Minn.	0.01
Anchorage	Alaska	0.01	Jackson	Miss.	0.01
Attu	Alaska	0.01	Pascagoula	Miss.	—
Cold Bay	Alaska	0.01	Jefferson City	Mo.	0.01
Fairbanks	Alaska	0.01	Helena	Mont.	0.03
Juneau	Alaska	0.01	Lincoln	Nebr.	0.01
Kodiak	Alaska	0.01	Concord	N. H.	—
Nome	Alaska	0.01	Trenton	N. J.	0.02
Point Barrow	Alaska	0.01	Santa Fe	N. Mex.	0.03
St. Paul Island	Alaska	0.01	Albany	N. Y.	0.03
Phoenix	Ariz.	0.09	Buffalo	N. Y.	0.01
Little Rock	Ark.	0.01	New York	N. Y.	—
Berkeley	Calif.	0.02	Gastonia	N. C.	0.02
Los Angeles	Calif.	0.02	Bismarck	N. D.	0.01
Denver	Colo.	0.02	Columbus	Ohio	0.01
Hartford	Conn.	0.01	Painesville	Ohio	0.01
Washington	D. C.	0.02	Oklahoma City	Okla.	0.02
Jacksonville	Fla.	0.01	Ponca City	Okla.	0.03
Miami	Fla.	0.01	Portland	Oreg.	0.02
Atlanta	Ga.	0.03	Harrisburg	Pa.	0.01
Agana	Guam	([a])—	San Jaun	P. R.	—
Honolulu	Hawaii	0.02	Providence	R. I.	0.02
Boise	Idaho	0.02	Columbia	S. C.	0.02
Springfield	Ill.	0.01	Pierre	S. D.	0.02
Indianapolis	Ind.	0.02	Nashville	Tenn.	0.01
Iowa City	Iowa	0.01	Austin	Tex.	0.01
Topeka	Kans.	0.02	El Paso	Tex.	0.02
Frankfort	Ky.	0.01	Salt Lake City	Utah	0.02
New Orleans	La.	0.02	Barre	Vt.	0.02
Augusta	Maine	0.02	Richmond	Va.	0.01
Presque Isle	Maine	0.02	Seattle	Wash.	0.02
Baltimore	Md.	0.02	Madison	Wis.	0.01
Lawrence	Mass.	0.02	Cheyenne	Wyo.	0.02
Winchester	Mass.	0.02	Sundance	Wyo.	—
Lansing	Mich.	0.02			

[a] Dash denotes no data received.

ENVIRONMENTAL LEVELS OF RADIOACTIVITY AT ATOMIC ENERGY COMMISSION INSTALLATIONS

The U.S. Atomic Energy Commission receives from its contractors quarterly reports on the environmental levels of radioactivity in the vicinity of major Commission installations. The reports include data from routine monitoring programs where operations are of such a nature that plant perimeter surveys are required.

Various summaries of the environmental radioactivity data for 18 AEC installations have appeared in *Radiological Health Data* since November 1960. Summaries follow for Feed Materials Production Facilities (Third and fourth quarters 1961) and Pinellas Peninsula Plant (calendar years 1960 and 1961).

The measured concentration of a radionuclide in air and water may be compared with the Maximum Permissible Concentration (MPC) of that nuclide as recommended by the National Committee on Radiation Protection and Measurement (NCRP)*. For the environment near an AEC installation, the applicable MPC's are one-tenth of the occupational MPC values for continuous exposure given in National Bureau of Standards "Handbook 69." The MPC values applicable to the following reports are given in table 1.

TABLE 1.—SELECTED ENVIRONMENTAL MPC VALUES PERTAINING TO AEC INSTALLATION REPORTS IN THIS SUBSECTION

Line no.	Radionuclide or mixture of radionuclides	Environmental MPC's	
		Water ($\mu\mu c$/liter)	Air ($\mu\mu c/m^3$)
1	Uranium (natural)	20,000	2
2	Tritium oxide (H^3_2O)	3,000,000	200,000
3	Tritium gas (H^3_2)		40,000,000

* The Federal Radiation Council has not published radioactivity concentration guides for uranium and tritium.

Feed Materials Production Facilities

Third and Fourth Quarters 1961

Malinckrodt Chemical Works
Weldon Spring, Missouri

Environmental monitoring results at the Feed Materials Production Facilities (FMPF), Weldon Spring, Missouri, are expressed in special uranium microcuries since uranium ore concentrates constitute the primary feed material. As defined in the National Bureau of Standards "Handbook 69," the units of concentration in this report are based on a curie of recently extracted uranium equal to the sum 3.7×10^{10} d/s from U–238, 3.7×10^{10} d/s from U–234, and 9×10^{8} d/s from U–235.

Process chemical wastes and other process residues are permanently retained in storage facilities located at both the site and two storage sites located adjacent to the Lambert-St. Louis Municipal Airport and at a quarry near the Missouri River (see figure 1). The plant process sewer, which carries the remaining water effluent from the operations into the Missouri River, is automatically sampled daily to permit continual measurement of any release of uranium-bearing material into the river. Off-site water samples are also collected from lakes, creeks, and rivers located within the plant's watershed. Air samples are collected on-site along the plant perimeter fence and on building roofs.

Third and fourth quarter results and the annual summary data that follow indicate that the average release of uranium-bearing materials from FMPF during 1961, as in the previous year, was substantially below the MPC for nonoccupational areas for natural uranium. The average uranium concentration found in off-site samples collected during the Fourth quarter 1961 decreased slightly from

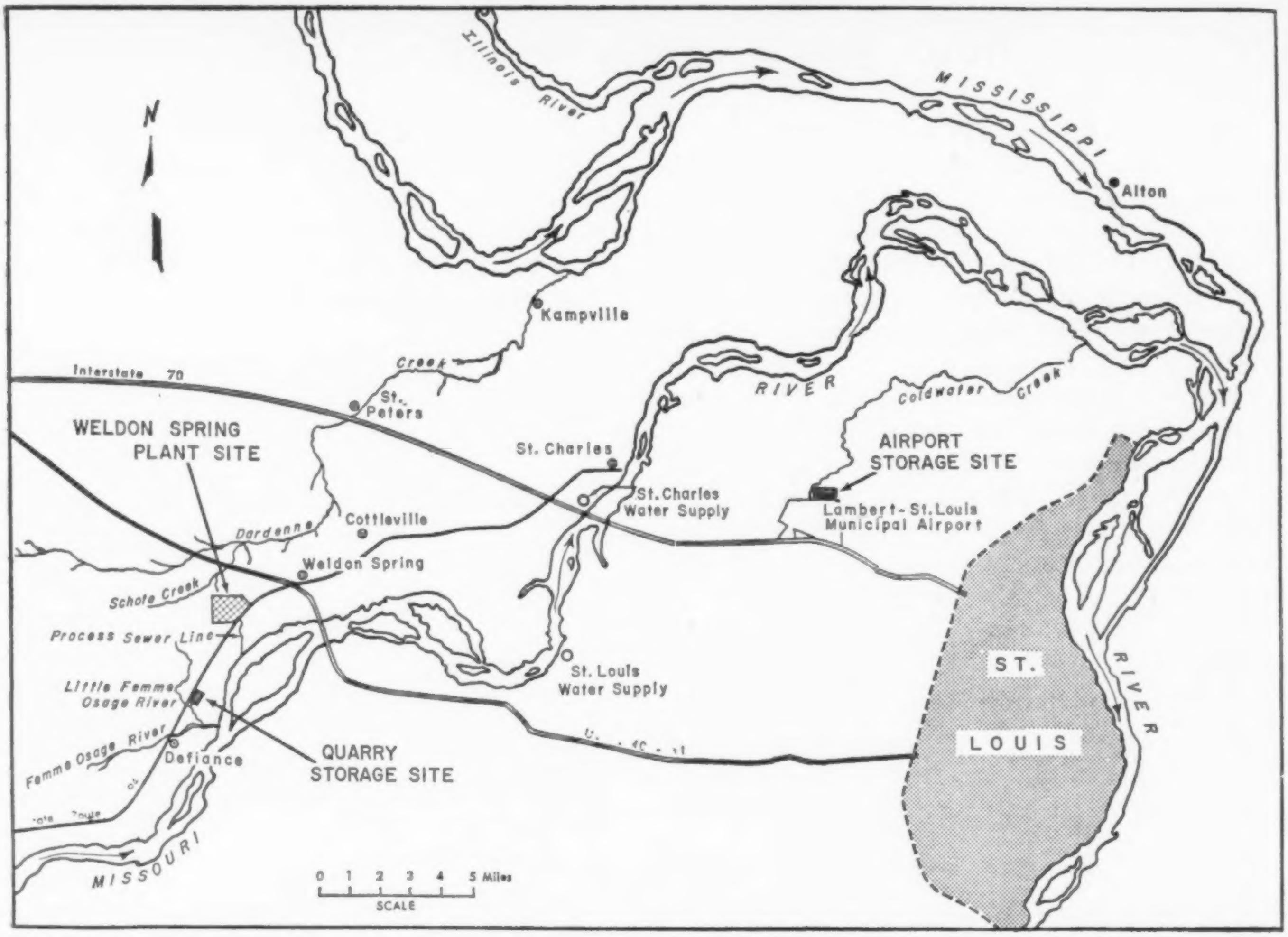

FIGURE 1.—LOCATION OF FEED MATERIALS PRODUCTION FACILITIES, WELDON SPRING, MISSOURI

TABLE 2.—URANIUM CONCENTRATIONS IN AIR

[Average uranium concentrations in μμc/m³]

On-site sample location			Third quarter 1961		Fourth quarter 1961	
Site	Position	Direction from plant	Number of samples	Uranium concentration	Number of samples	Uranium concentration
Plant	Fence line	Northeast	2	0.189	3	0.029
	Roof	East	3	0.015	3	0.376
	Fence line	North	3	0.044	3	0.009
	Roof	Northwest	3	0.082	3	0.644
	Open area	Southwest	3	0.010	3	0.004
	Roof	Southeast	3	0.106	3	0.502
	Not reported	South-southwest	1	0.040	3	0.038
	Not reported	West	2	0.089	3	0.068
	Not reported	North-northwest	2	0.055	3	0.021
	Average			0.070		0.188
Quarry	Edge of quarry	South	2	0.019	2	0.082
Airport	4 locations	3 North, 1 South	7	0.049	5	0.010

TABLE 3.—URANIUM CONCENTRATIONS IN WATER

[Average concentrations in $\mu\mu c$/liter]

Sampling locations	Third quarter 1961		Fourth quarter 1961	
	Number of samples	Uranium concentration	Number of samples	Uranium concentration
Process sewer, plant site	61	230	59	530
Missouri River sampling points:				
Defiance, upstream	3	10	3	1
Femme Osage junction, upstream	2	3	3	<2
Process sewer outfall	3	110	3	110
U. S. Highway 40–61, north side	3	2	3	7
U. S. Highway, 40–61, south side	3	1	3	2
St. Louis City water plant intake	3	1	3	2
St. Charles City water plant intake	3	1	3	<2
Plant off-site sampling points:				
Lake across from plant entrance	3	1	3	<2
Lake, east of plant	3	1	3	1
Lake, north of plant	3	2	3	<2
Lake, west of plant	3	1	3	1
Dardene Creek, upstream	3	<1	3	<1
Dardene Creek, Cottleville, Bridge	3	7	3	5
Dardene Creek, St. Peters	3	3	3	6
Dardene Creek, Kampville	3	4	3	3
Schote Creek, upstream	3	2	3	21
Schote Creek, downstream	3	20	3	1
Plant surface drainage, west	3	78	3	160
Plant surface drainage, north	3	17	3	280
Quarry off-site sampling points:				
Little Femme Osage (LFO), ½ mile upstream	2	3	3	1
Branch, LFO, ½ mile upstream	2	1	3	2
LFO, at quarry discharge culvert	2	5	3	5
LFO, ¼ mile downstream	2	1	3	<1
LFO, 1¼ mile downstream	2	1	3	2
Airport off-site sampling points:				
Cold Water Creek, adjacent to site	3	2	3	1
Drainage ditch, north of site	1	400	1	70

TABLE 4.—REVIEW OF URANIUM CONCENTRATIONS IN THE ENVIRONMENT OF FMPF, WELDON SPRING MISSOURI, 1960–1961

[Average concentrations in percent of appropriate MPC's][1]

Source of possible contamination	Sampling type and location	Calendar year 1960	Calendar year 1961	1961			
				First quarter	Second quarter	Third quarter	Fourth quarter
Plant site	Air plant perimeter	9.6	11.4	37.0	3.2	3.2	9.4
	Water, process sewer	4.2	1.7	1.7	1.0	1.1	2.6
	Water, Missouri River downstream	0.22	0.19	0.55	0.10	0.10	0.12
	Water, streams and ditches	0.33	0.48	0.80	0.16	0.60	0.30
	Water, lakes	0.11	<0.02	0.02	0.01	<0.01	<0.01
Quarry storage site	Air, south edge		2.2	2.8	1.7	0.9	4.0
	Water, streams	0.02	<0.02	0.01	0.02	0.01	0.01
Airport storage site	Air, site perimeter	0.78	1.6	—	2.4	—	0.5
	Water, streams and ditches	0.15	0.30	—	0.5	—	0.09

[1] Environmental MPC's for uranium as given in NBS Handbook 69, page 86, are 2 $\mu\mu c/m^3$ for air and 20,000 $\mu\mu c$/liter for water.

samples collected during the third quarter. However, over the year a 1.7 percent increase is evident from comparison of percent MPC values for 1960 and 1961.

Air Monitoring

Monthly air samples are collected on-site along the plant perimeter and on building roofs by six high volume sampling pumps. During 1961, monthly samples were also collected by three windmill sampling pumps located south-southwest, west, and north-northwest of the plant. Semiannual air samples are collected at four points on the perimeter of the airport storage site, and monthly air samples were begun during the first quarter of 1961 at the south edge of the quarry. Third and fourth quarter air data are reported in table 2 and incorporated with review data in table 4.

Water Monitoring

In addition to daily samples from the plant process sewer, monthly off-site water samples are collected from lakes and streams located within the plant's watershed, the Missouri River, and streams near the quarry at the points indicated in table 3.

Previous Coverage in Radiological Health Data

Periods covered	*Issues*
1959 and First Quarter 1960	November 1960
Third and Fourth Quarters 1960	November 1961
First and Second Quarters 1961	November 1961

Pinellas Peninsula Plant

January 1960–December 1961

General Electric Company
St. Petersburg, Florida

Environmental monitoring at the Pinellas Peninsula Plant (PPP) includes sampling of a single combined sewer effluent, several local dairy farms, and air, water, and vegetation obtained at locations suggested by meteorological conditions and radioactivity discharge concentrations. With the exception of air, which may include tritium gas, the radioactivity content in samples is tritium oxide

No air samples were collected during the first three quarters of 1961. During 1960 and the fourth quarter 1961, air sampling revealed no detectable concentrations of tritium gas or tritium oxide. Occasionally the tritium concentrations in the combined sewer effluent were detectable. There were no indications of tritium in milk, vegetation, or other water samples analyzed.

Environmental monitoring data for both years indicate that radioactivity discharges from the Pinellas Peninsula Plant have negligible effects on the environment.

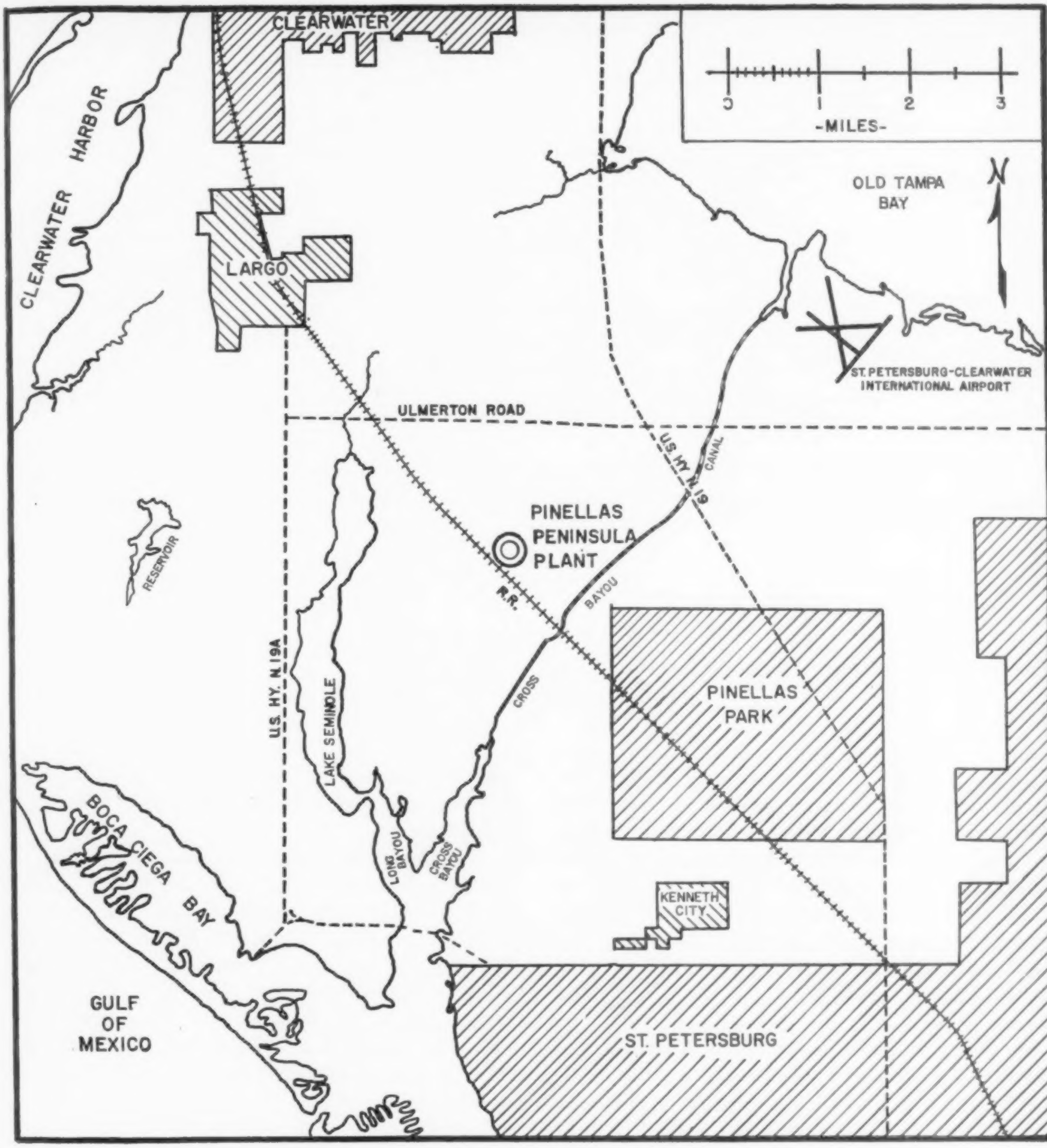

FIGURE 1.—LOCATION OF THE PINELLAS PENINSULA PLANT SITE

Table 1.—TRITIUM CONCENTRATIONS AT THE PINELLAS PENINSULA PLANT

Sampling details		1960	1961 First–third quarters	1961 Fourth quarter
Plant sewer effluent	Number of samples	235	166	58
	Average concentration	<110,000	<110,000	<110,000
(μμc/liter)	Maximum concentration	480,000	180,000	<110,000
Surface water	Number of samples (0–6 miles from plant)	331	164	32
	Average concentration	<110,000	<110,000	<110,000
(μμc/liter)	Maximum concentration	<110,000	<110,000	<110,000
Vegetation	Number of samples (0–6 miles from plant)	518	295	56
	Average concentration	<500,000	<500,000	<500,000
(μμc/kg)	Maximum concentration	<500,000	<500,000	<500,000
Raw milk	Number of samples (1–5 miles from plant)	15	30	15
	Average concentration	<110,000	<110,000	<110,000
(μμc/liter)	Maximum concentration	<110,000	<110,000	<110,000
Air:				
Tritium gas (μμc/m³)	Number of samples (0–2 miles downwind from plant)	29	0	6
	Average concentration	<3,000,000	—	<1,300,000
	Maximum concentration	<3,000,000	—	<1,300,000
Tritium oxide (μμc/m³)	Number of samples (0–2 miles downwind from plant)	Included in tritium gas measurements	0 —	11 <2,000
	Average concentrations	------------	------------	<2,000
	Maximum concentrations	------------	—	<2,000

Reported Nuclear Detonations

June 1962

Since October 1961, summary information on all known nuclear detonations during the month preceding publication have been regularly reported in this section of *Radiological Health Data*. As the May and June issues of *RHD* inadvertently skipped numbers in the consecutive numbering sequence, the table below recapitulates all tests through March with revised test numbers, including tests conducted during June 1962.

On June 9, 1962, Joint Task Force 8 announced the temporary extension of the Johnston Island test area in the Pacific for the next high altitude test in the megaton range because of the expected intensity of light from the detonation.

The area remained circular in shape with the radius extended to 530 nautical miles at the surface, using Johnston Island coordinates (16° 45′ North, 169° 31′ West) as its center. The radius increased gradually to 1050 nautical miles at 40,000 feet. This represented an increase of 60 nautical miles at the surface and 350 nautical miles at 40,000 feet. The enlargement of the Johnston Island area took effect on June 12.

REPORTED NUCLEAR DETONATIONS BY THE UNITED STATES, MARCH–JUNE 1962

Test number	Location	Date	Yield range*	Type of test
20	Nevada Test Site	March 5	Low	Underground.
21	Nevada Test Site	March 6	Low	Underground.
22	Nevada Test Site	March 8	Low	Underground.
23	Nevada Test Site	March 15	Low	Underground.
24	Nevada Test Site	March 28	Low	Underground.
25	Nevada Test Site	March 31	Low	Underground.
26	Nevada Test Site	April 5	Low	Underground.
27	Nevada Test Site	April 6	Low	Underground.
28	Nevada Test Site	April 12	Low	Underground.
29	Nevada Test Site	April 14	Low	Underground.
30	Nevada Test Site	April 21	Low	Underground
31	Christmas Island, Pacific	April 25	Intermediate	Atmospheric.
32	Christmas Island, Pacific	April 27	Intermediate	Atmospheric.
33	Nevada Test Site	April 27	Low	Underground.
34	Christmas Island	May 2	Low megaton	Atmospheric.
35	Christmas Island	May 4	Intermediate	Atmospheric.
36	Christmas Island	May 6	Not announced	Nuclear warhead in missile launched from Polaris submarine.
37	Nevada Test Site	May 7	Low	Underground.
38	Christmas Island	May 8	Intermediate	Atmospheric.
39	Christmas Island	May 9	Intermediate	Atmospheric.
40	Christmas Island	May 11	Intermediate	Atmospheric
41	Christmas Island	May 11	Low	Underwater.
42	Nevada Test Site	May 12	Intermediate	Underground.
43	Christmas Island	May 12	Intermediate	Atmospheric.
44	Christmas Island	May 14	Intermediate	Atmospheric.
45	Christmas Island	May 19	Intermediate	Atmospheric.
46	Nevada Test Site	May 19	Low	Underground.
47	Nevada Test Site	May 25	Low	Underground.
48	Christmas Island	May 25	Low	Atmospheric.
49	Christmas Island	May 27	Intermediate	Atmospheric.
50	Nevada Test Site	June 1	Low	Underground.
51	Nevada Test Site	June 6	Low	Underground.
52	Christmas Island	June 8	Intermediate	Atmospheric.
53	Christmas Island	June 9	Intermediate	Atmospheric.
54	Christmas Island	June 10	Low megaton	Atmospheric.
55	Christmas Island	June 12	Intermediate	Atmospheric.
56	Nevada Test Site	June 13	Low	Underground.
57	Christmas Island	June 15	Intermediate	Atmospheric.
58	Christmas Island	June 17	Intermediate	Atmospheric.
59	Christmas Island	June 19	Low	Atmospheric.
60	Nevada Test Site	June 21	Low	Underground.
61	Christmas Island	June 22	Intermediate	Atmospheric.
62	Nevada Test Site	June 27	Intermediate	Underground.
63	Christmas Island	June 27	Megaton	Atmospheric.
64	Nevada Test Site	June 28	Low	Underground.
65	Christmas Island	June 30	Low megaton	Atmospheric.
66	Nevada Test Site	June 30	Low	Underground.

* Low yield range has been announced as meaning about a nominal (20 kiloton) yield; intermediate yield meaning the range between nomina and one meg ton; and low meg ton meaning more than one, but less than 5 megatons.

UNITS AND EQUIVALENTS

For the convenience of the reader, a selected list of units and equivalents frequently used in *Radiological Health Data* (*RHD*) is presented below.

Symbol	Name of unit	Equivalents
cpm	count per minute	
dpm	disintegration per minute	
$\mu\mu c$	micromicrocurie	$1\ \mu\mu c = 1\ pc = 2.22$ dpm
pc	picocurie	
mc/km^2	millicurie per square kilometer	$1\ mc/km^2 = 1000\ \mu\mu c/m^2 = 2.59\ mc/mi^2$
mi^2	square mile	
m^2	square meter	
m^3	cubic meter	$1\ m^3 = 1000$ liters
gm	gram	
kg	kilogram	1 kg = 1000 gm = 2.2 lbs
mm	millimeter	precipitation: $mm = \frac{\mu\mu c/m^2}{\mu\mu c/liter}$
mr/hr	milliroentgen per hour	
Mev	million electron volts	

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